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SELECTION OF PROJECT MANAGERS IN A GOVERNMENT RESEARCH LABORATORY A STUDY OF THE DECISION PROCESS

by

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Thesis Supervisor

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Chairman, Departmental Committee on
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The Proper Study of Mankind is Man

Alexander Pope, "Essay on Man"

Letter of Transmittal

Professor Philip Franklin
Secretary of the Faculty
Massachusetts Institute of Technology
Cambridge, Massachusetts

Dear Professor Franklin:

In accordance with the requirements for graduation, I herewith submit a thesis entitled "Selection of Project Managers in a Government Research Laboratory: A Study of the Decision Process."

I would like to express my appreciation to those at the government research laboratory where the investigation was undertaken for giving so generously and willingly of their time and effort in helping me with this endeavor.

I would like to thank Professor Geoffrey P. E. Clarkson for his encouragement, Professor Donald G. Marquis for his enthusiastic support and Professor William F. Pounds for his guidance in turning a nebulous idea into a concrete task that was so very rewarding to me personally. And I wish to thank all of these gentlemen for their advice and consul and for generously giving me benefit of their knowledge and previous experience in the field of study.

Sincerely yours,

Andrew G. Swanson

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SELECTION OF PROJECT MANAGERS

IN A GOVERNMENT RESEARCH LABORATORY

A STUDY OF THE DECISION PROCESS

by

Andrew G. Swanson

Submitted to the Alfred P. Sloan School of Management on May 11, 1964, in partial fulfillment of the requirements for the degree of Master of Science.

ABSTRACT

One of the important decisions made by administrators in a government research laboratory is the selection of managers of research and development projects. In execution of these projects, large sums of public funds are frequently involved and the prestige of the laboratory and sometimes the prestige or safety of the nation may depend on the successful completion of the project. Therefore it would be desirable to find means of improving the process of project manager selection. Fundamental to any search for means of improving the process is an understanding of how that process is being performed. This study was initiated with the purpose of gaining insight into the process of selecting managers for projects in a government research and development laboratory.

One method of obtaining insight into a decision process, such as project manager selection, is to search for a similarity in methods used by various decision makers in making similar decisions; that is, to see if there is any pattern discernable. To put the question another way, can the process be understood to the point where one could conceive of programming a computer to simulate the process? The idea here is to describe a level of understanding of the process and not to advocate that the process be reduced to a computer simulation.

Several decision makers who have responsibility for selecting project managers were interviewed at a government research and development laboratory. Six were interviewed quite intensively to obtain answers to the question of how project managers were being selected. Therefore, real people and real situations were discussed in the interviews.

In addition, a hypothetical project was invented and four decision makers at the laboratory were asked to select managers for this project from a list of hypothetical candidates who were invented and described with detailed histories and characteristics.

On the basis of the interview data, it was concluded that the process of selecting project managers is an understandable and describable process even though it is carried out in an informal and mostly unconscious manner. A model of the decision process was made; data from the test cases were not in conflict with this model.

Since a pattern was found in the decision process, it is believed that the results will have application to improvement of the particular decision studied and also to the more abstract purpose of understanding decision processes in general.

Thesis Advisor: Donald G. Marquis

Title: Professor of Industrial Management

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CHAPTER I

INTRODUCTION

General Background

One of man's ancestors made the decision to come down from the trees; he was then faced with the problem of how to live in this new environment. From the beginning of his existence, man has always had problems to solve and decisions to make. However, a scientific study of the processes used in this mental work is of fairly recent origin. And what might be called an engineering approach to this investigation (as opposed to a philosophical approach) is apparently only a decade old, originating in the development of electronic computers or data processing machines.

The problem of trying to discover how a man makes decisions or solves problems is a difficult one. These processes are carried out in the brain through the mechanism called thinking. Man has not yet devised a transducer which can relate the electro-chemical processes taking place in the brain, when the thinking activity is taking place, to the end item of the decision made or the problem solved.[1]

A working description of the thought process can be made at a level which is a few steps removed from the immediate physiological mechanism. The writing of a program to instruct an electronic computer or data processing machine seems to contain some of the elements of a representation of what it is that man does when he thinks. It

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[1]The terms decision-making and problem-solving are used more or less interchangeably although it is obvious that a distinction can be drawn between them.

is probably a somewhat rudimentary representation; nevertheless, there is an intuitive appeal to the idea that the programming process is a close relative of the human thought process.

> One of the characteristics of the computer that makes it unique among technical achievements is that it has forced men to think about what they are doing with clarity and precision. A man cannot instruct the computer to perform usefully unless he has thought through what he's up to in the first place, and where he wants to go from there.[2]

That the programming process is close to the thinking process certainly seems true for solving mathematical types of problems where one follows an algorithm. But machines have also been programmed to do such things as write music; the machines evidentally do not "think" in the manner of a professional composer, but it is highly likely that the program procedures are not much different than those of a beginning student in harmony who largely applies rules learned by rote--but mainly heuristic rules rather than a strict following of an algorithm.

One of the first realizations of the possibilities inherent in computer programming techniques for simulating human thought processes seems to have been on the part of Allen Newell and J.C. Shaw of the Rand Corporation and Herbert A. Simon of Carnegie Institute of Technology. Their pioneer paper on the subject was published in

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[2]Gilbert Burck, "The Boundless Age of the Computer", Fortune, LXIX (March 1964), p. 101.

1958.[3]

The initial goal of Newell, Shaw and Simon was to program a computer to solve some theorems of symbolic logic (from Whitehead and Russell's Principia Mathematicia). It was obvious to them that such a program would have to use heuristics and that the machine (or more basically, the program) would have to "think" in somewhat the same fashion as do humans in order to be able to prove the theorems. They found that when they had a program which would prove most of these theorems, that they also had a program that exhibited the same logical thought pattern as human subjects who were asked to "think aloud" while solving some of these same theorems. Further descriptions of this study are given in other papers by these investigators.[4]

But note that:

> We wish to emphasize that we are not using the computer as a crude analogy to human behavior--we are not comparing computer structures with brains, nor electrical relays with synapses. Our position is that the appropriate way to describe a piece of problem solving behavior is in terms of a program: a specification of

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[3]Allen Newell, J.C. Shaw, and Herbert A. Simon, "Elements of a Theory of Human Problem Solving", Psychological Review, LXV (May 1958), pp. 151-166.

[4]Allen Newell, J.C. Shaw, and Herbert A. Simon, " A General Problem-Solving Program for a Computer", Computers and Automation, VIII (July 1959), pp. 10-17.

Allen Newell and Herbert A. Simon, "The Simulation of Human Thought", Current Trends in Psychological Theory, ed. Wayne Dennis (Univ. of Pittsburg Press, 1961), pp. 152-179.

Allen Newell and Herbert A. Simon, "A Computer Simulation of Human Thinking", Science (Dec. 22, 1961). Reprinted in: Timothy W. Costello and Sheldon S. Zalkind, Psychology in Administration: A Research Orientation (New Jersey: Prentice Hall, Inc., 1963), pp. 359-371. This book also contains other articles on problem-solving and

> what the organism will do under varying environmental circumstances in terms of certain elementary information processes it is capable of performing. This assertion has nothing to do--directly--with computers. Such programs could be written (now that we have discovered how to do it) if computers had never existed. A program is no more, and no less, an analogy to the behavior of an organism than is the differential equation to the behavior of the electrical circuit it describes. Digital computers come into the picture only because they can, by appropriate programming, be induced to execute the same sequences when they are solving programs.[5]

A significant step in applying this new approach to a description of the decision process was made by Clarkson.[6] He studied the decision process of a trust officer in a bank selecting a stock portfolio for trust investment. Through use of extensive interviews and tape recorded protocols, he was able to construct a model and computer program which simulated the decisions made by this trust officer to a high degree of accuracy. That is, given the requirements to invest a given amount of money and the purpose of the investment (growth, income or some combination thereof), Clarkson's program instructed the computer to choose essentially the same investment portfolio as was chosen by the bank officer to meet the same objectives. In addition, Clarkson so programmed the machine that the output was in the form of English language statements rather than a numerical readout. The statements "made" by the computer in

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decision making as seen by experimental psychologists and mathematical statisticians as well as the Newell, Shaw and Simon article.

[5] Newell, Shaw and Simon, "Elements of a Theory of Human Problem Solving", p. 153.

[6] Geoffrey P. E. Clarkson, Portfolio Selection: A Simulation of Trust Investment ("The Ford Foundation Dissertation Series"; New Jersey: Prentice Hall, Inc., 1962).

selecting its portfolio were compared to statements made by the human trust officer (in the recorded protocol) when he made his portfolio selections. Since it is virtually impossible to distinguish between the output of the computer and the "output" of the human trust officer it can be said that Clarkson's program could closely simulate the thought process of a human in that a modified form of Turing's Test[7] could be passed. The original form of Turing's Test was along the following lines:

> A human interrogator sits in one room, a human respondent in another and a computing machine in a third. The interrogator asks questions (written rather than oral) and the human and machine respondents give written replies. If the interrogator cannot tell whether the machine or the human is answering his questions, then the machine has passed Turing's Test and, at least in some sense of the word, can be said to "think".

In Clarkson's work, the test is made somewhat less stringent in that the "interrogator" is restricted in the questions he can ask, but in view of the similarities in machine and human data, the computer program can be said to pass a Turing's Test in simulating the thought processes of the human.

Clarkson's work is also described in an article by Clarkson and Pounds[8] which discusses some additional implications (and problems) associated with the approach to the simulation of human thought processes.

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[7] A.M. Turing, "Can a Machine Think?," The World of Mathematics, ed. J.R. Newman (New York: Simon and Schuster, 1956) pp. 2099-2123.

[8] Geoffrey P.E. Clarkson and William F. Pounds, "Theory and Method in the Exploration of Human Decision Behavior", Industrial Management Review, V (Fall 1963), pp. 17-27.

The Problem to be Studied

With the foregoing background, the particular investigation to be described in this paper will now be outlined. My goal is somewhat more modest that that of the previously mentioned researchers. I do not carry the problem to the point of programming a computer but rather consider the question of whether or not a particular decision process seems sufficiently understandable to discern a pattern which would describe the process; or, if you will, could I see a possibility that the process could be programmed. The decision to be examined is that of selection of project managers in a government research and development laboratory.

Selecting people for responsible management positions is a critical decision for any enterprise--whether private or public. During the course of their studies in the Alfred P. Sloan School of Management at M.I.T., the Sloan Fellows have the opportunity to meet with top level executives of many such concerns. The majority of these executives have stated that one of the more important problems they face is deciding who should be placed in positions of responsibility. Proper selection of project managers is no less an important decision in a government agency than in a private business concern. Many projects involve quite large sums of taxpayer's money and/or the nation's prestige may be involved. Also, the selection of managers for smaller projects is often equally crucial for a variety of reasons (among them being that the small project is sometimes as essential component of the larger one).

The problem originally considered was; "How could (or should

the process of selection of project managers be improved?" It was suggested that attempts to answer this question would not be very fruitful unless the question of how project managers are being selected now, in actuality, was answered first. Therefore my research has a dual purpose. I wish to explore the decision process of selecting managers with a view to finding means of improving that process. But the broader goal is to endeavor to gain insight into that process as another step in the general investigation of human decision processes.

When the research was undertaken, the fundamental question was whether or not the process of selecting people for management jobs was sufficiently understandable and describable so that a pattern could be found to the process. Another way of saying this is that the question was whether or not the process was one which could be conceived of as being simulated by a computer program. Note that this does not necessarily mean that it would be desireable to program the process. The idea of whether or not a process could be programmed deals with the adequateness of one's understanding of the process or with the idea of how structured one believes the decision process to be. Simon describes[9] programmed or structured decisions as those that are sufficiently repetitive and routine that a definite procedure has been worked out for handling them as opposed to, at the other end of the continuum, a non-programmed decision that requires a one-shot, ill-structured, novel approach.

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[9]Herbert A. Simon, The New Science of Management Decision (New York: Harper and Row, 1960), p. 5.

Newell, Shaw and Simon's original work[10] was a study of solving a problem in symbolic logic where symbols were manipulated according to definite rules. In Clarkson's study[11], the decision maker is also dealing with tangible "things" such as stock prices and yields. Because of the numerically or mathematically describable nature of the items with which these decision makers were concerned, it was not immediately obvious that a decision could be conceived of as one which could be programmed where the "items" to be decided upon were human beings.

Therefore, the research undertaken for this thesis was in the direction of first trying to determine if the process of selecting a project manager was a thing that could be reduced to a pattern or program (or if some decision makers already regarded it as such), and second, if it was so reducible, to try and define the basic outline of such a program--not for the purpose of trying to reduce the process to a computer routine but rather for the purpose of trying to sharpen my understanding of the process.

Some Definitions

Before discussing the process of selecting project managers, a definition is needed of what a project is and who the manager is, although it is probable that the reader has a sufficiently accurate intuitive definition. The following quotation covers much of the

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[10] Newell, Shaw and Simon, "Elements of a Theory of Human Problem Solving."

[11] Clarkson, op.cit.

ground:

> Generally speaking, the project manager's business is to create a product--a piece of advanced-technology hardware. . . . A project is an organizational unit dedicated to the attainment of a goal--generally the successful completion of a developmental product on time, within budget, and in conformance with predetermined performance specifications. . . . Projects are typically organized by task (vertical structure) instead of by function (horizontal organization) . . . The project manager is the man in between management and the technologist--the one man in the organization who must be at home in the front office talking about budgets, time schedules and corporate policies and at home in the laboratory talking about technical research and developmental problems.

This definition is designed for an industrial concern; our definition needs a slight modification in the sense of taking a broader view of the word project. A project will be defined as a research task (usually applied rather than basic) or a development task that has a reasonably well specified end object and completion date. This end item will generally be a piece of hardware; although, a well defined study effort whose end item is a report or similar document will also be considered a project. The end item does not have to be of major significance; but, in order to qualify as a project, the work will have to encompass several technical disciplines and several divisions at the research laboratory will have to be involved.

The project manager is that individual who is given prime responsibility and authority for execution of that project. He need not be in a separately established office and his staff may be scattered physically. On large projects he will usually report to

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[12]Paul O. Gaddis, "The Project Manager", Harvard Business Review (May/June 1959), pp. 89-97.

the laboratory top management through no more than one level of line supervision. He is the one who is supposed to see that the project "goes" and to brief management on what is going on. Small projects may be separate entities or part of larger projects; however, the person responsible for this project will be considered a project manager if he otherwise meets the above definitions, except his line of reporting may be to an overall project manager or through several levels of line supervision.

CHAPTER II

DATA SOURCES

The main sources of data were interviews with personnel of a government research and development laboratory. Additional data were also obtained from a questionnaire about a hypothetical case history which was given to some of the same people and, in slightly modified form, to several Sloan Fellows at the M.I.T. Alfred P. Sloan School of Management.

The top management structure of this laboratory consists of a director, an associate director and several assistant directors. The next lower management level is that of division chief, several of whom report to each assistant director. The next step in the structure (after assistant division chiefs) is branch head. Intensive interviews were held with six people in these various levels of management structure. Brief interviews were also held with about a dozen or so additional people ranging from the level under the branch head up to and including division chief and also including two project managers.

The top level management approves all project managers, but in practice, they are actively engaged in the selection procedure for only the larger projects. Division chiefs or even branch heads in essence make the selection for smaller projects. On larger projects, one or more division chiefs (and occasionally a branch head) is asked for an opinion on the selection. Only a limited number of people are involved in any selection: therefore, it is believed that the limited number of people interviewed represent a reasonable cross section of those responsible for project management selection.

The interviews were done in three phases. In the first phase, four people were interviewed at length and significant portions of three of these interviews were tape-recorded for further analysis. The interviews were loosely structured and followed no set pattern although in each of them a specific set of questions was asked:

1. Do you have any current projects for which you are trying to select a project manager? If not, then what was the most recent project?
2. When did you first realize that the project was going to come into being and that a manager would have to be appointed?
3. At what time did you start considering specific individuals for managers?
4. How many people did you consider might be suitable for the job?
5. In what sequence did you consider the people?
6. What was your general process for selecting?
7. What were the reasons you thought those people might be suitable?
8. In what order were these reasons considered?
9. What were the reasons for rejecting people?

It was found that the decision makers could not be captured in the act of making an actual selection for a project manager; therefore, the next best thing was to try and have them talk about their most recent selection. I tried to make them relate any philosophical opinions of selection procedures to this most recent selection; these attempts were not always successful, but most opinions were illustrated by a specific actual occurence. No strong attempt was made to keep the interviews on a straight and narrow path; rather, questions were asked to develop any statement that seemed interesting. But the essence of the above list was covered.

Real people and real situations were discussed, some of the interviewees being franker than others. Because of the desire to preserve the anonymity of the interviewees and of the people they dis-

cussed, the interviews cannot be reproduced verbatim herein. However, quotations or paraphrases will be made at appropriate points to support the ideas presented.

The data obtained in the initial interviews were analyzed and a tentative pattern for the decision process of project management selection was evolved. Additional people were then interviewed (and some re-interviewing was done) with the idea of trying to see if the tentative pattern seemed valid. Essentially the same line of questions was asked, but additional questions were also asked, such as:

1. Which position do you most frequently find yourself in--looking for a manager for a prospective project or looking for a project for a prospective manager?
2. When looking for a manager, do you first consider the problems that will be caused by making him a manager (e.g., selecting a line supervisor for project management which might require selection of a replacement line supervisor) or do you find the man you want and then consider these other effects on the organization?

It was during this second phase that most of the briefer interviews were held. The objective of these brief interviews was to see how widely the pattern of the decision process seemed to be valid.

For the third phase, it was decided that a test of the tentative pattern established for the process of project manager selection could be made and additional data on the decision process obtained at the same time. A hypothetical project was invented along with four hypothetical people who were candidates for the position of project manager. Four of those interviewed were asked to select the one of these people whom they considered most qualified for that position and rank the others in order of desirability. Meanwhile I was to predict (from the model of the decision process) which candidate

would be selected and why. If the predictions were in reasonable agreement with the choices of the decision makers at the laboratory, then I could assume that perhaps I understood the process. And if not, then perhaps the differences would provide further insight into what the processes really are.

As a further test several Sloan Fellows at the M.I.T. Alfred P. Sloan School of Management were given a slightly modified version of the same hypothetical project and case histories and were asked to select the manager. Half of this group were told no more than this, the other half were given a more detailed procedure to follow (which was based on a portion of the pattern believed to be uncovered in the original interviews). The hope was that there would be significant differences in the selections made by those having essentially no directions and those having a "recipe" to follow in making their selections.

It should be noted that the interpretations of the interview data are my own and that there is not necessarily a correspondence between what I believe to be the patterns and methods involved in selection of project managers at the research and development laboratory and what the interviewees believe to be the process--or, for a third alternative, what is really the true process. Also, most of the data were obtained from interviews in which people described what they were thinking, and:

> . . . a protocol is relatively reliable only for what it contains, but not for that which it omits. For even the best-intentioned protocol is only a very scanty record of what actually happens.[13]

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[13] K. Duncker, "The Structure and Dynamics of Problem-Solving Processes" (Psychological Monographs on Problem Solving, LVIII, No. 270, 1945). Reprinted in Costello and Zalkind, op. cit., p. 349.

CHAPTER III

A MODEL OF THE SELECTION PROCESS

General Remarks

Generally one presents the data before one presents the conclusion drawn therefrom. However, the reader probably will be able to follow the analysis of the data more easily if a portion of the conclusion is presented first. In this chapter a model is presented which I believe describes the decision process used in selection of project managers at the government laboratory. The model is presented without any arguments as to why I believe it to be valid. Such arguments are presented in the next two chapters along with the data obtained in the interviews; it was from these data that the model was deduced.

The model presented is not a detailed mathematical description. It is in the nature of a series of general flow diagrams in which most of the specific details are implied rather than explicitly described. The model is intended to provide a general description rather than a verbatim reproduction of the decision maker's process. In addition to providing a description of the process, the object of presenting the model is to persuade the reader that since the process can be reduced to a series of general flow diagrams, it is not unreasonable to conclude that the process could be programmed on a computer.

It was found that the steps in the selection process for choosing project managers were carried out, for the most part, subconsciously or semi-consciously by the decision maker. In no case

was any sort of written check list or procedure used. And the conscious steps that were followed were not routinized to any degree. But in spite of these facts, the differences in processes of the decision makers were remarkably uniform; differences were subtle and, for the most part, reflected not so much basic differences in procedure as differences in certain detailed aspects of that procedure.

Other investigators[14] have found that there are three aspects to a decision maker's processes: there is a memory which stores information on factors in the process, a set of basic information processes which operate on data stored in memory and a set of rules which describe how these processes are to be used. I believe that these elements are the important building blocks on which this model rests and that their presence will be obvious to the reader. The fact that the model is built from these rudiments is one of the reasons that I conclude that the process follows an understandable pattern, or that it is a process which could be programmed.

Selection of Potential Candidates

Before a decision maker can select a manager for a project, he must have a list of people from whom to choose. A description of the process of generating this list is shown in figure 1. The list is generated by observing people perform in their jobs and reviewing their capabilities. Each time contact is made with people, a re-evaluation of their attributes is made. This re-evaluation may not be complete; that is, only one facet of their attributes may be consid-

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[14] See, for example, Clarkson and Pounds, op.cit., pp. 17-18.

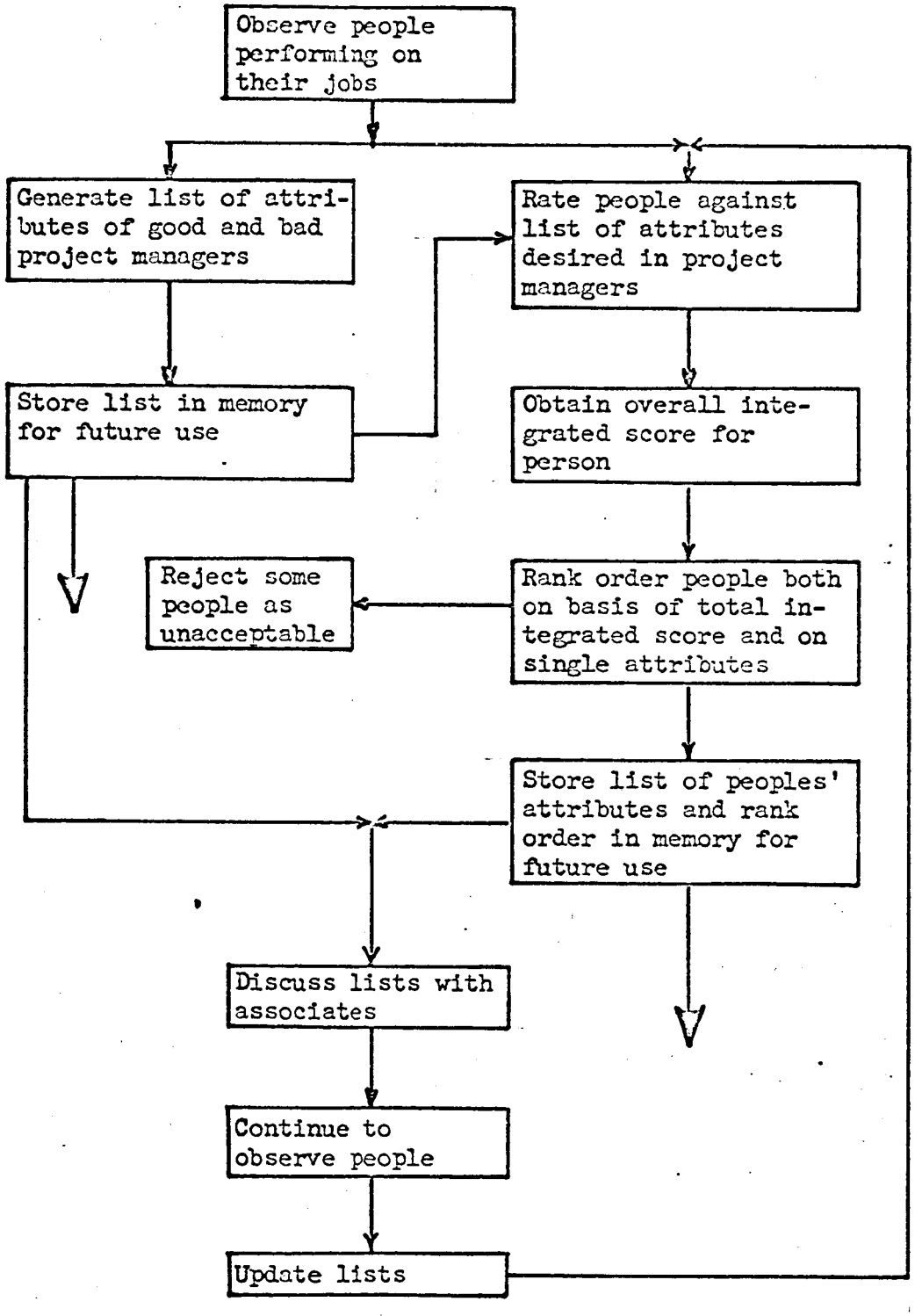

Figure 1.- Flow diagram for generating lists of potential candidates.

ered. And the evaluation is generally carried out at an unconscious level in the decision maker's mind.

Although none of the decision makers said so, it seems reasonable to assume that the attributes of the candidates are measured not only against their own past performance but also against some "standard". That is, the decision makers, by observing both people and the "goodness" or "poorness" with which their jobs are being done, must generate a list of qualities that make for "good" and "bad" project managers. While the decision maker probably has some self-generated abstract qualities in his list of desirable attributes, it is probable that the main sources of data are the people being observed. This list of desirable attributes is also formed largely on a subconscious level.

There is some conscious thought in this list generation, but apparently relatively little. The majority of the conscious thought is probably generated during discussion of a person's abilities with associates of the decision maker.

The forming of these lists, the observing and ranking of people's abilities, is done in large measure independently of the process of selection of project managers; that is, the process is carried out automatically on the part of the decision maker out of the main stream of the project manager decision pattern. For, whether or not he has a project job in mind for the person being observed, the decision maker has line supervisory positions or salary raises to consider. Therefore, the observations are a vital part of the decision maker's total job.

Project Definition

The first part of the project manager selection process that is in the main stream of the pattern is the project definition phase. A flow diagram which describes this part of the process is shown in figure 2.

As opposed to the candidate list generation (figure 1), the project definition phase is often carried on, at least in part, in fairly conscious fashion and, indeed, in sometimes fairly formal fashion. Parts of the process are often discussed with associates of the decision maker. Also, it is likely that the technical and stature requirements are determined in part by using data filed in the decision maker's mind as a result of the type of activities shown in figure 1.

This phase also provides the possibility of rejecting the project, particularly on the grounds that one of the decision maker's "own" people cannot do the job. The definition of who "our people" are will vary according to the hierarchial level of the decision maker. With few exceptions, the branch head would tend to look at people in his branch and the division chief at people in his division. Top management people view the whole laboratory as the domain to be considered, subject, of course, to some obvious limitation of not considering certain people such as clerks, etc. The top management, and even some division chiefs, would not be acquainted with all people in their domain; but, they would be likely to know all people who are sufficiently high level in experience and/or rank to be considered for the job. That is, there is a matching of the size and importance

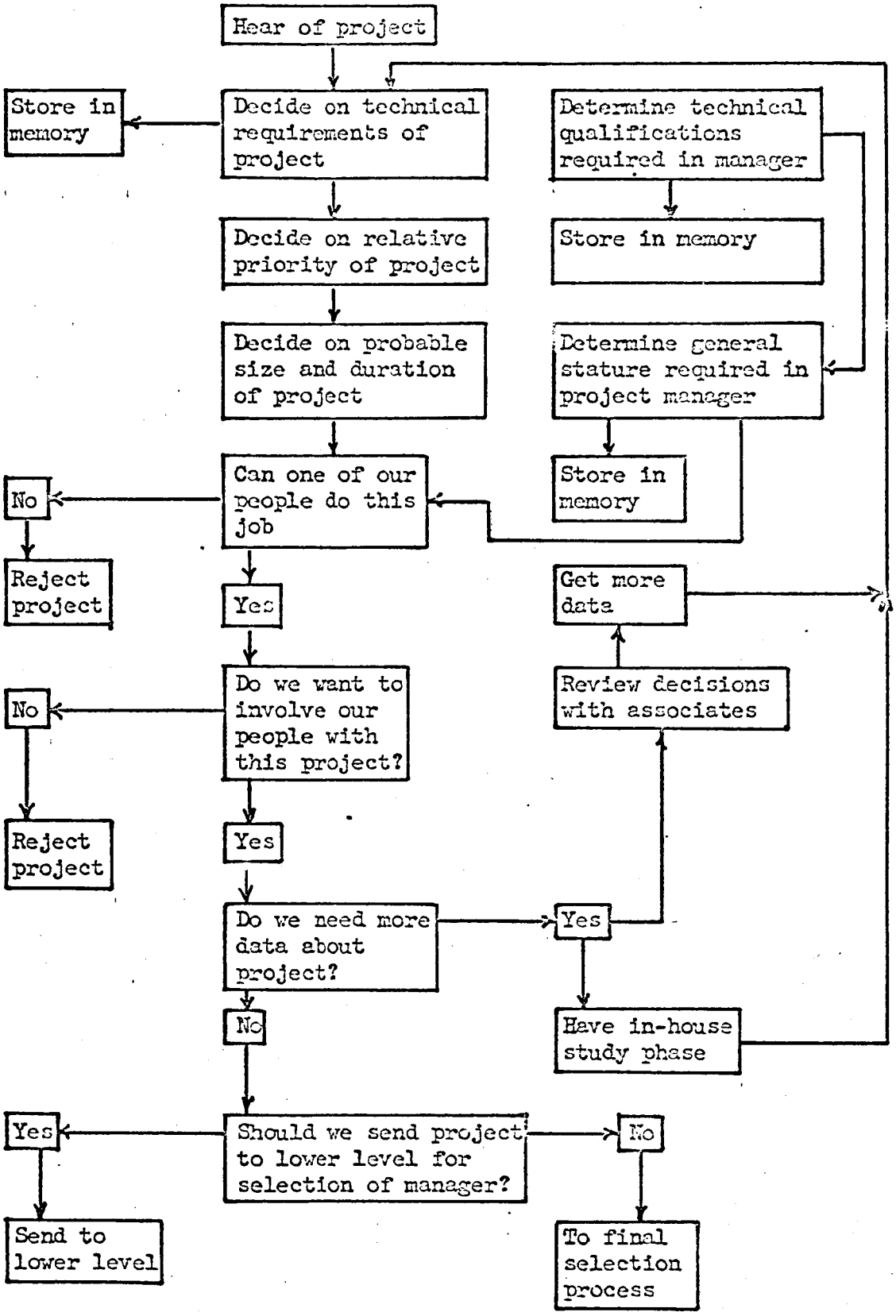

Figure 2.- Flow diagram for Project Definition Phase.

of the project with the administrative level at which the manager is chosen; for example, managers for small projects are not chosen by the top management of the laboratory but by branch heads (with occasional review of decisions at higher levels). This limitation to a selection from one's "own" people is done primarily for competitive reasons, particularly when the decision maker is at a lower administrative level; but, there are some practical reasons as discussed in subsequent chapters.

The prime items in this phase of the process are the decisions as to the priority of the project and the technical needs of the project. The technical needs seem to come closer to dictating the selection of the project manager than any other item. This is particularly true when there is some "pre-selection" of the manager (pre-selection is discussed in the next section).

Feedback loops are shown in figure 2 which may or may not be involved in any specific project manager selection. For bigger projects or for vaguely defined projects (particularly those that are generated internally) there may be several trips through these loops, and the study-phase feedback loop is apt to be fairly extensive. The study phase, and the cycling through the loops seem to be used to define the project requirements more sharply so that definitive answers can be obtained as to whether or not the project should be done and as to what type of person is desired for project management. The greater the precision attained in the project definition phase, the more likely is the pre-selection method to be used in deciding on the project manager.

The Final Selection Process

The final step in the decision process, the final selection phase, is undoubtedly the most subjective phase of all. None of the decision makers seemed to have much of a conscious thought pattern in performing the final selection and arriving at their actual choice for a project manager. No real good description of this phase was given by any of the decision makers; therefore, in the flow diagram which describes this phase, figure 3, more than in the other phases, I have had to fill some of the steps in the process from an intuitive "feel" acquired during the interviews.

It was in this phase that most of the detailed differences in procedures were found. Some of these differences in procedures were found in different decisions by the same decision maker; this seemed to be true more so than differences arising because different decision makers were involved. These differences in procedures are labeled by three different "routes" in figure 3, routes A, B, and C.

Route B is the route that most decision makers seem to actually use; this is the route where "pre-selection" is used. That is, based on the data stored in the decision maker's memory about potential candidates, the decision maker performs an immediate matching of candidate and project as soon as the project description phase is completed. After tentatively selecting this man, the rest of the effort on route B is an effort on the part of the decision maker to justify his "pre-selection" choice. This justification procedure may be thought through in a semi-conscious to unconscious manner; but the pre-selection is almost always based on an unconscious matching procedure. If

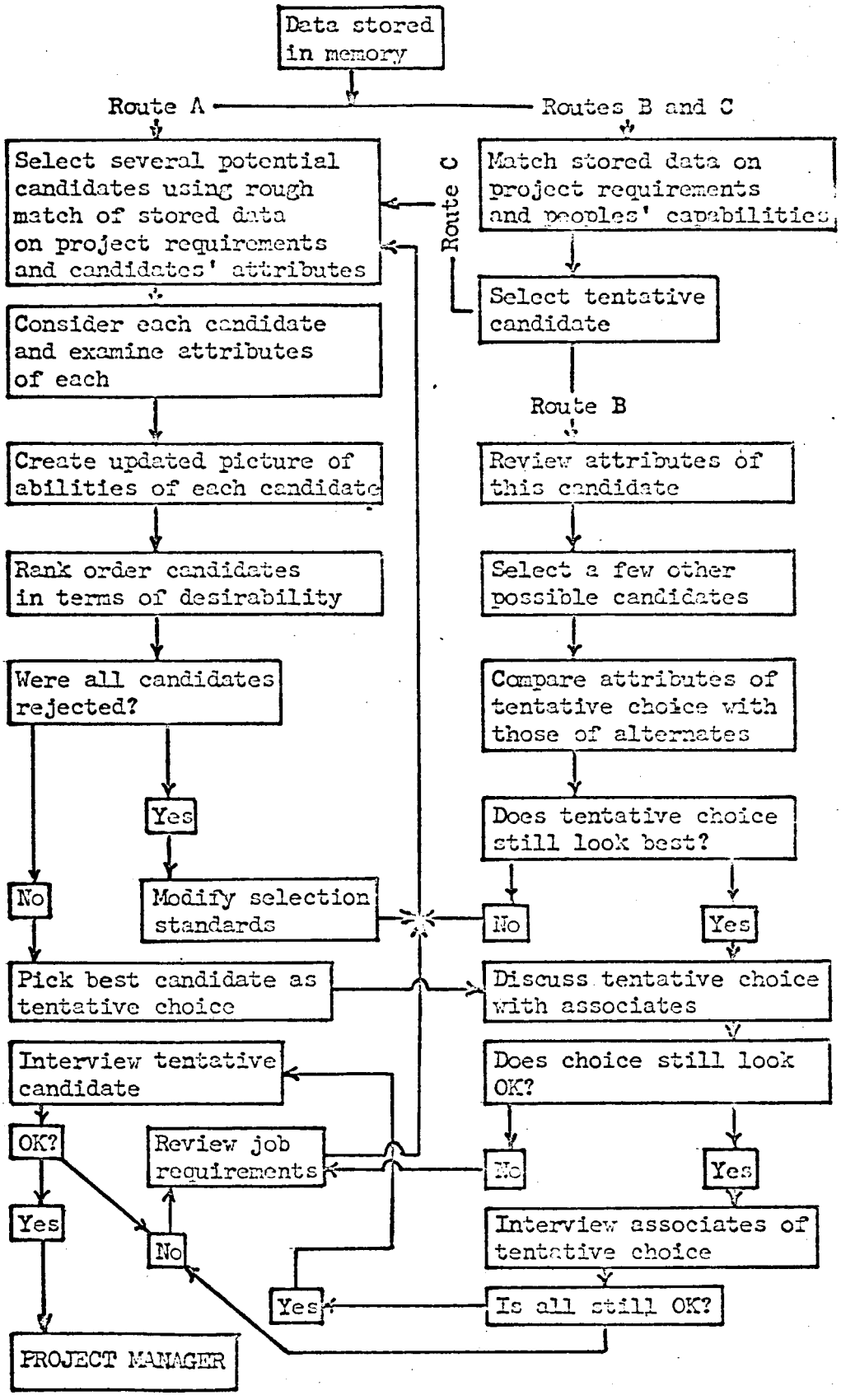

Figure 3.- Flow diagram for final choice selection.

the justification is done consciously and deliberately, then route C is followed. It would not be unreasonable to say that route C is just a repetition of route B; the two routes, B and C, have been distinguished in order to differentiate between processes that are largely unconscious and those that are fairly deliberate, conscious and semi-formal.

Route A could be called the "logical" or "correct" route and several decision makers claimed to follow such a procedure all of the time. Actually, there is some evidence to indicate that route C is usually the path followed when the decision maker thinks he is following route A. That is, there is probably an element of "pre-selection" in all choices. But most decision makers would somehow consider this to be a "bad" or "unfair" procedure and would, therefore, claim to follow route A. "Pre-selection" does not seem to be "bad" necessarily, particularly if the decision maker is "honest" and "rational" and does indeed provide for the possibility of "changing his mind" as we have shown on all routes.

The changing of one's mind probably never happens prior to discussions of tentative choices with associates of the decision maker. These discussions will be quite limited in number (usually one or two peers and subordinates). The number of associates of the potential candidate who are interviewed will also be quite limited and these interviewees also will usually be subordinates of the decision maker. And the purpose of these interviews will usually be hidden from the interviewee.

When the candidate is being interviewed, he will usually be

told that he is being considered for the job and that the purpose of the interview is to establish whether or not the candidate has a strong interest and desire in this project management job or whether there is some personal factor, such as health, that would preclude the candidate from accepting the job (or being acceptable).

Some Missing Elements

There are some possible missing elements in the decision process as it has been described. No data were obtained on the amount of influence prejudices and political pressures play in the decision process. It is probable that the decision makers would claim that their decisions are not influenced by such factors; they probably at least hope so. Whether or not they are correct is a question that is beyond the scope of this investigation.

It is also interesting to note that the steps of obtaining data from subordinates as to which people might be considered for a project management job do not seem to be a factor until a candidate has tentatively been selected. This is probably due to the fact that the observation phase (figure 1) where general lists of candidates are made is done, in part, in consultation with these subordinates and also due to the fact that the project definition phase provides an opportunity to send the project to a lower level for actual project manager selection if it is deemed desirable.

Attributes Desired in a Candidate

The attributes desired in a project manager are determined from what the man has done and the desire is that the man's past

performance and abilities show that the man can accomplish the job to be done. Katz[15] described the attributes required in a manager as the possesion of three types of skills: technical, human and conceptual. The attributes discussed by all of those interviewed are really a more elaborate listing of skills that fall into these three catagories. The varied way in which these attributes were identified will be presented in the next two chapters but they can be stated in the following format (using the catagories of skills suggested by Katz):

Technical skills:

1. Does the man have sufficient technical skill in the major field of interest in the project?

2. Does the man have sufficiently broad technical abilities and background to be adequately conversant with all of the technical disciplines involved in the project?

3. If the project is to be done with the services of a contractor, does he have appropriate experience in negotiation and administration of contracts?

Human skills:

4. Can he establish a team effort through his abilities to work with people, command respect, and establish esprit de corps and enthusiasm?

5. Can he communicate his ideas and delegate responsibility for execution of these ideas?

6. Is he a good judge of people and can he properly utilize and weigh the opinions of experts?

7. Does he have sufficient aggressiveness and drive?

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[15]Robert L. Katz, "Skills of an Effective Administrator", Harvard Business Review, XXXIII (January/February 1955), pp. 35-42.

Conceptual skills:

8. Can he properly plan the work of both himself and others?

9. Can he properly assess and co-ordinate the various requirements of broad areas of activity?

10. Can he make timely decisions and establish the proper balance between thought and action?

For major projects this might be called a list of minimum attributes--if the man doesn't have these, he is not likely to be considered a promising candidate for the job of project manager. For minor projects one or more attributes could be missing, particularly if it was thought there was a potential for development of them. Smaller projects sometimes are used as training vehicles for people who appear to be capable of taking on larger responsibilities in the future.

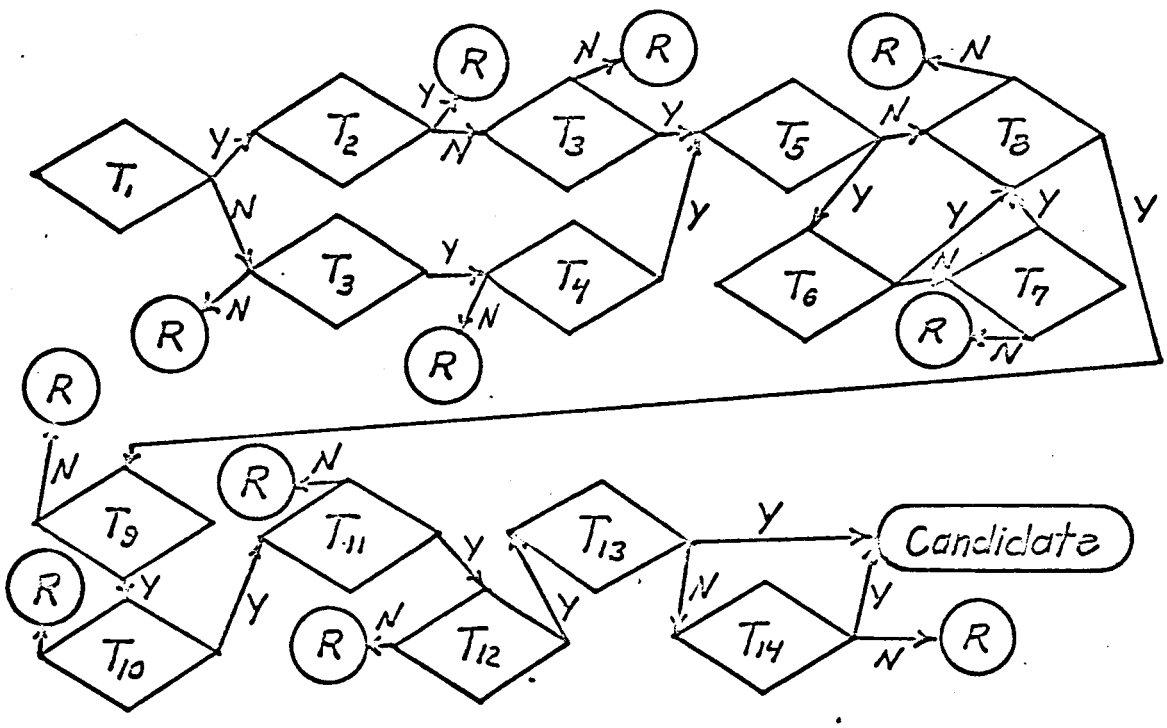
But, different projects require different weighting of these attributes. And for the same project, one decision maker will weight different attributes by different amounts. For example, a decision maker who was primarily concerned with schedules and costs might weight the factors of planning and co-ordinating abilities or contractual administering experience more heavily than technical ability. A decision maker who was more concerned with mission performance requirements would likely put the emphasis in reverse order. However, all decision makers interviewed said that all of these attributes were required, although, their way of describing the attributes varied.

The list of attributes sounds somewhat idealistic, but it was obvious during the interviews that the attributes, as described by the decision makers, were considered by them to have definite and useful meanings.

Attribute Decision Tree

The flow diagrams in figures 1-3 are fairly general. A somewhat more detailed diagram is shown in figure 4 which shows how a series of tests of a candidate's attributes might be made. These tests could be incorporated in one of the routes for final decision shown in figure 3 and are in a form popular among decision theorists, a decision tree. This tree cannot be deduced directly from any of the data obtained in the interviews but is rather an attempt to describe in somewhat formal fashion how some of the unconscious thoughts of the decision makers might be executed. The description is probably too detailed and at the same time insufficiently complex, but I believe it should provide some additional insight into the decision maker's probable process and I feel intuitively that it is somehow close to "reality".

The decision tree could be used by the decision maker in rating potential candidates (figure 1) as well as in making the final selection (figure 3). In rating prospective managers, the tree would probably be used in two ways; for rough sort selections and for actual ranking. In both of these situations the tree would have to be followed all the way through and instead of "rejecting" people, a note would be made of which test was "failed" and some sort of "failing score" assigned. Then the decision maker would have to "back up" and follow the rest of the tree. The final integrated picture would be based on the number of tests "failed" and the "score". Also, some sort of numerical "score" would be given to the tests "passed" in making this integrated evaluation. In a rough sort selection, the



T_i = Test Number i R = Reject Y = Yes N = No

TESTS:

1. Does he have technical background in this particular field.
2. Is he too much of a specialist.
3. Does he have a broad technical background.
4. Could others be assigned to project staff to make up for his lack of special technical knowledge.
5. Is experience in dealing with contractors required.
6. Does he have experience in contract negotiation and administration.
7. Could others on project staff make up for lack of this type of experience.
8. Does he get along well with people.
9. Can he command respect from people.
10. Can he delegate responsibility.
11. Does he communicate well.
12. Will he have adequate drive and enthusiasm.
13. Is he interested in this job.
14. Can he be persuaded to become interested.

Figure 4. Decision Tree for Testing Attributes.

integrated picture for many people would probably be that of "just doesn't have it" or "not ready yet" with perhaps the most important failing noted and stored in memory. For candidates who are kept on the active list, some sort of "ranking" by "total integrated score" would be stored in memory together with some data on the "scores" on specific tests "passed" and "failed".

In the final selection process, candidates are probably rejected if they fail a test. Here the order of the test is important; but, the order is not necessarily that shown in figure 4. The order may vary with time for any one decision maker and will vary from decision maker to decision maker. The order will depend on the type of problem of most concern to the particular decision maker at the particular time. If technical problems have been the ones of main concern of late, then these tests will be applied first.

Implied in the tree is a quantitative weighting of the factors that are included in each question. That is, very few of the questions can be answered flatly yes or no. The true answer is that it all depends. The man has "enough" of some quality and what amount will be deemed sufficient will depend on the nature of the project, the nature of the decision maker, and the nature of the decision maker's recent experience with various projects with which he is concerned. The nature of this quantitative weighting is indicated in part by tests T_1 and T_5 where alternate paths with additional tests are shown, depending on whether a yes or no answer is received, instead of a go-no-go answer.

In addition to alternate paths, there is undoubtedly a differ-

ence in "scoring" required for one test depending on what the "score" was on a previous test. The "score" would not be given numerically on a conscious basis; rather a subconscious "feeling" about a person would be stored away in memory which would bear some relation to a conscious numerical "score". A man who did well on T_1 , say a "score" of 99, would perhaps only require a "score" of 60 on T_8 and vice-versa. And, as previously mentioned, sometimes 75 would be good enough on T_1 and at other times the "score" would have to be much higher.

Summary

I have outlined the process that decision makers seem to be using in selecting project managers. While those interviewed expressed the method used and attributes required in somewhat different words, the degree of similarity among all the descriptions of these processes was very high. No arguments were presented in this chapter to support the conclusion that the process is as described. These arguments are presented in the following two chapters. The purpose of this chapter is to provide a background for evaluating the arguments and data to be presented.

CHAPTER IV

INTERVIEW DATA

In this chapter the data obtained from the interviews of decision makers at the government laboratory will be presented. It was from these data that the decision patterns presented in the previous chapter were deduced. The data are mostly in the form of quotations. Some are verbatim quotations (with editing done mainly to preserve anonymity) and some of the "quotations" are actually paraphrases of quotations or from notes made during the interviews. In a further effort to preserve anonymity, I will not distinguish between notes, quotations, paraphrases or interviewees. I am certain that, in adopting this procedure, I am not distorting the interviewees' remarks in order to prove a point. However, as noted in Chapter II, there is a possibility that the conclusions drawn are not synonymous with the interviewees' intended meanings.

In this chapter reference is made to the figures which were presented in Chapter III.

Project Definition Phase

One of the things to be established from the interviews was which came first, the project or the man. Some typical statements were:

> The project comes first. If the nature of the project isn't defined, you can't select the proper project manager--the project defines the man. For example, the type of man required depends on how much supervision he will have. Will there be a separate project office required or will the project be handled within a division where division personnel will be involved in some of the key decisions--or will the man have to make these decisions in his own office. . . . On project __, we were working on some

> preliminary studies of various phases of it before it ever became a project where it was necessary to appoint a manager.
>
> Circumstance dictates the approach to the problem of selection, but the project definition usually comes first and establishes the requirements for the manager.
>
> You pick the project engineer depending on the sort of project you have in mind. If you had a project where you knew exactly what was to be done and it was just a matter of doing it you might pick someone with less imagination than was the case in project __ where we couldn't quite see our way all the way through.

Similar remarks were made by other interviewees which give credence to the idea that defining the project is essential before a manager can be selected.

There are exceptions, however, to the idea of the project coming before the man. One interviewee pointed out that if a man suggests an idea for a project which he is encouraged to pursue, and then if he goes back to his office and studies it further and comes up with a solid worth-while proposal, then he may be given the job of running the project. One reason for giving him this job would be that the ability to transform a vague idea into a concrete proposal is one indication that the man could be a successful project manager. But, a man is not put in charge of a project <u>just</u> because he thought of it. So even this exception appears not to be a strong violation of the pattern in that the attributes of the man must be weighed against the needs of the project--and the project needs cannot be defined until the proposal is finished and evaluated.

Another apparent violation of the idea of the project definition coming first is in some of the statements of the interviewees where the training function (that is, the use of small projects as a means for "growing" managers) was regarded as an important part of

the job. For example, in response to the idea that he seemed occasionally to be looking for a project for a man rather than a manager for a project, one man said;

> Yes, this is very true. It ties in with a basic idea I have of developing the whole technical group--to make it a strong mature capable group. You have to match up jobs that are challenging with each man--taking into consideration his strong points and his weak points--his state of development--and perform a match of job and man. But, I am not just running a training school, for the jobs are in support of what is going on in the laboratory--we have got to help the laboratory do its job and its mission.

It seems that implicit in this discussion is the idea that the project must be understood before a manager can be selected even if you are looking for a project with which to challenge a man and train him. The manager in this process is pre-selected--and if the project and man fail to match, it is perhaps more reasonable to say the project is rejected rather than the man. However, as this interviewee said, the work must support the laboratory's missions; therefore, one is not always free to select the project but must sometimes take what comes. When training is considered, there are some additional tests added to the final selection process, such as:

(1) Will the project challenge the man?
(2) Will it be too much of a challenge?
(3) If the challenge might possibly be too much, are there enough other people available who can back-stop him--that is, bail him out if he gets in trouble?
(4) Should we take the gamble of making this challenge?

These questions are drawn from other portions of interviews where the training function was discussed.

That the relative importance of projects is important is shown by statements such as the following:

> You don't always have the man you want available--he may be busy somewhere else on a more important project.

> Availability of the man is an important factor, that is, is his present job more important than the new one.
>
> You have to make trade-offs on availability. This doesn't mean that a man has to be free, but only that you can make a trade-off between the project that he is on and the new project that is coming up. You have to make a decision as to whether the merit of the new project is such that you want to take him off the old job and put him on this new project. It is strictly a trade-off in the value to the government of the new project.
>
> You have to establish the hierarchy of project priority--the pecking order between projects.

Also, it was noted that people sometimes are not considered for some jobs because they are too "busy"--which implies that the new project has less importance than that to which the man is presently assigned. Something else is also implied; there is not an "infinite" reservoir of men sitting idle waiting for a new project to come along so they can get to work managing it--which is not unreasonable and in fact is a desirable situation. But the fact that people are doing constructive work does not preclude the fact that something more constructive could come along which would demand their talents.

The balancing of the priority of jobs is perhaps one of the more important responsibilities of a decision maker--particularly in a research laboratory where one's activities must change if one is to stay in a leading position. One of the decision makers described this problem very nicely when he was discussing the availability problem:

> There is a tendency to perpetuate things--to create an <u>illusion of activity</u>. If a project continues too long, the quantum jumps in the creation of new knowledge start to become smaller and smaller.

As mentioned in the previous chapter, the problem of deciding whether or not one's "own" people could do the job of managing a new project is not entirely a selfish motive. To be sure, as one inter-

viewee put it, the element of competitiveness does make you think of putting one of your own people in as manager of a project you have been asked to do and you have a tendency to reject the project, probably on the grounds of "busy-ness" (i.e., implied more importance of present work), if you cannot see your way clear to do so. This is probably more true of project manager selection for smaller projects where a branch or division is selecting the manager than it is where the whole laboratory is the domain--but even here:

> First of all we certainly look within our own organization. These people know the other people in the laboratory, they know where to go for help--they have been through the process before.

A man who is familiar with the people, the facilities and the procedures will be apt to do a better job of management than an outsider, provided of course, he was otherwise qualified. Another factor is:

> You must have firsthand knowledge of the man--for this reason you would seldom pick an outsider--you would probably turn down a project if you thought one of your own people couldn't handle it.

The probability of knowing a candidate adequately well is higher if you select from within than if you pick an outsider. Another factor that is probably important when considering "importing" talent is that of morale. Morale is higher if people can see promotion from within.

Some of the additional factors considered in the project definition phase (figure 2) were defined in consideration of other phases of the selection process. For example, one of the attributes required of a man was appropriate technical experience for the project--which implies that the technical qualifications required had to be established in the project definition phase. The "stature" requirement

was implied by remarks about certain people who seemed otherwise qualified for a job but who just had not been around long enough to acquire "experience" or who were not well enough known or just did not have a high enough civil-service or line-supervisor position. It is possible that "stature" is merely shorthand notation for all of the attributes other than technical ability that a man must have to manage a given project.

The question of whether or not the decision maker is interested in involving his people in this project may be a restatement of the idea that: "We can't find one of our own people who is qualified to manage the job." But probably it means more nearly that: "It doesn't seem as important to us as the work that is now being done by the people who would have to do this new job." It also may mean that: "This job is a good one and we'd like to do it, but there are just too many messy politics involved." In any event, it is known that projects have been turned down with essentially the statement of not wanting to involve people with it as grounds for rejection.

Observing People Phase

Before one can sort out people to choose from for a defined project, there must be a list to choose from (figure 1). How is such a list generated? The following quotation from Simon gives the essence of the process:

> To some limited extent we have learned how to assess human qualities by formal testing. In the main, however, we select a good decision maker for an organizational position by looking for a man who has done a pretty good job of decision making in some other organizational position that is almost equally taxing. This is a simple-minded approach to the problem, but it is the

only moderately successful one that we know. [16]

Tests can measure the wrong things or be misinterpreted; therefore, until testing is developed into a much more precise science, personal judgment of people's qualifications will continue to be a strong factor when people are evaluated for positions.

The simple-mindedness which Simon refers to seems to be simple minded in two ways. First, decision makers may not use to good advantage the scientific knowledge on human behavior that is available. Second, they might be more systematic in their observing, evaluating and selecting procedures. It is the second process with which this thesis is concerned.

In this study, I am not trying to advocate the replacement of a human decision maker by a machine. Rather I am trying to see if to some extent the decision maker is already thinking in a systematic fashion. If so, it could be concluded that the process could be improved by additional formality.

Before returning to the interview data, we will consider from another source the degree of success being obtained with Simon's "simple-minded " procedure. During a luncheon meeting in December 1963, the Sloan Fellows of the M.I.T. Alfred P. Sloan School of Management were asking questions of Mr. Alfred P. Sloan, Jr. of General Motors Corporation. One of the questions asked about the main criteria he had for promoting people to higher management positions. Mr. Sloan's answer

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[16]Simon, The New Science of Management Decision, p. 12.

was dynamically and emphatically given: "Demonstrated capacity to perform". Observations of a person's performance, then, can be given some pragmatic support since General Motors is often presented as the epitome of success in management capability, and the success patterns of General Motors were largely formed when Mr. Sloan was at the helm.

It will now come as no surprise to the reader to discover that the decision makers interviewed formed their impressions of people's abilities by observing them perform.

> You want a man who has demonstrated by his past history that he has these capabilities required of a project manager--preferably on some major project so you will have a guide on how he performs in this type of job.
>
> You have to have experience with a man . . . you start with your experience of the man's experience. The picture of the man is made from observations made in a random sample of incidents. But you can still get a good line on a man in this way if the process is done over enough time.
>
> Question: These are the types of things you have filed away in your mind about a man? Answer: Yes, that is right. There is a continual evaluation of people.
>
> Question: How do you get a comparison among people with these qualities? Answer: I think the fairest way to do it and the way that is used most often is to base your opinions on their past performance.
>
> Evaluation is a dynamic process. People and jobs change; therefore, evaluation must be a continuous process based on observations of the people.
>
> You find out about people by observation of them over the years.

Now we have really only considered the first item in the flow diagram shown in figure 1. But, it does not seem to stretch the imagination too much to fill in the rest of the diagram from these statements alone. In fact, the statements that the evaluation is a continuing process, and that the evaluation is made from a random

sample of observations made over a period of time essentially imply the rest of the diagram. There were a few more clues in the interviews which led me to believe that this inference is correct, but they are more subtle and are hidden in other statements rather than being directly stated. The pattern can be deduced sometimes from statements of how it is decided that people have certain attributes. The description of the attributes required or the attribute a man has (or hasn't) implies that a list of attributes desired has been generated from observations of people's performance, that people have been measured against these attributes, that an integrated picture has been formed and that the data is stored away in the memory of the decision maker.

The idea of integration of factors to arrive at a total impression was explicitly mentioned when the actual selection of a manager for a specific project was being made.

> You integrate all of these factors in your mind and arrive at a decision.
>
> These factors are gone through on a mental check list--all factors are integrated into a total score.
>
> Such things are in your mind--and you integrate all of them in your mind when you make a selection. You remember so and so is a good project engineer. You draw conclusions about these people in your contacts with them--and you keep your conclusions up to date.
>
> Question: Are you saying that you have sort of a generalized list of attributes that you carry around in your hip pocket all the time? Answer: Yes, that is right.
>
> I have a mental rating list of every man in the group--I break the group up into sub-groups having various orders of competence.

This is about all the direct evidence from interviews that shows that the pattern of getting a list of people and their attributes is as

shown in figure 1. A bit more evidence was obtained in some test cases which will be discussed in the next chapter. But a good bit of the deduction comes from a "feel" I acquired during the interviews that this must be the process used. If the reader believes that I have introduced too much of my own subjective opinion rather than basing conclusions on objective fact, then I can only hope that he will feel that the process, as it has been described, is at least plausible.

Final Choice Selection

Now it is time to fit together the use of the stored data on people and the definition of the project and actually select the project manager. Here it is even more likely that my own subjective opinion will enter into the description. All those interviewed were really somewhat vague on the process they use--and in some cases were even somewhat self-contradictory. This undoubtedly stems from the fact that few, if any, of the decision makers use a conscious selection process.

> There is no check off list, so far as I know, that anybody uses to predict the man who should be chosen. Now this may be used some places and it wouldn't be a bad idea, as a matter of fact.

> I don't have a form I fill out or anything like that. It is starting to dawn on me that the process is pretty subjective. I am not conscious of any very scientific procedure. It is subjective to my mind--maybe because I have been doing this sort of thing for a long time. There is something very fundamental to what I do--and it may or may not be right--but the way my mind works is entirely subjective.

> There doesn't seem to be any scientific selection process coming out of this does there? It is sort of subjective and intuitive.

> There is a thinking period while you are considering the project and people--and this is when people are eliminated. You think about it for quite a while and then say, "How about him for the job?

Nevertheless, I believe that there is a procedure, albeit mostly on an unconscious level. Also, there is some evidence to indicate that any conscious procedures used are frequently, but not always, adopted after an unconscious pre-selection of a candidate has been made. But the pre-selection is possible in a sense because the decision maker has "done his homework" and has filed away in his memory the characteristics of people; he can immediately match project and man when he hears the project description and determines the project needs.

> On project __, the technical problems dictated the research division that the man must come from. When people from that division were considered, the further requirement that __ type of experience was needed made us ask who from that division has the most of that type of experience. And immediately these questions yielded Mr. __. In this case it was obvious that Mr. __ would be the best choice as project manager as soon as the question came up.

> On project __, Mr. __ was one of the logical people to think of. The work involved the type of activities his division was familiar with. Because of his knowledge he would know where and how to put people.

Another factor in pre-selection is that the decision maker often isn't really sure why he made the selection he did until he gives the matter some conscious review.

> Selecting a project manager is sometimes similar to the process of writing a man up for a raise. You know the man deserves a raise, but when you sit down to make the write-up, you have to stop and think of the exact details of why he does. This is one reason why you can't pick a man unless you have had experience in dealing with that man.

But at least one decision maker is not concerned about the lack of formal procedure for the process of selecting managers:

> More than one person is considered, but rating and weighting is not done in any kind of system. A list of artificial questions is not created and one man given, say, 8.5 out of 10 and

> another 7.5. This could be done, but in the end any quantitative judgment must be handled qualitatively; quantitative evaluation is only a check on the qualitative. For example, when a contractor is evaluated in a job (and numerical ratings are used in contract awards) and he scores highest when you are really sure he should be second, then you must stop to see why. Usually you find that some factors were given certain weights and that these factors were improperly weighted. With hindsight you can see this--so one needs to re-do the weighting factors. The quantitative factors give way to qualitative. This is not cheating if it is done honestly--only if it is rigged. Flexibility is needed in an honest evaluation.

This man seems to be saying that people have not yet become smart enough to properly assess some factors, even on a hardware item where it should be possible to assess them numerically, and that numerical weighting of people is even more of an unknown thing and must be tempered with judgment. To which I can only heartily agree. But still it is likely that a formal procedure could be used as an aid to the decision maker's judgment, particularly if the decision maker doesn't have years of experience to aid his judgment.

So having made a pre-selection, what does the decision maker do next? He gives thought to his choice; sometimes consciously and sometimes unconsciously.

> I always deliberately consider a few other cases even if I am not seriously considering these other people. This always introduces a few other characteristics for you to measure a man against. You insure that your selection is good by mentally balancing him against other people.
>
> You look at the qualities required and the person almost simultaneously and the person you pick more or less comes to mind because you know what these people have done. Now in this process it is entirely possible that you miss people. In addition to just plain thinking of people off the top of your head, it is probably a good thing (and I do this) to actually get a whole list of top-grade people when it comes to very important projects. I look at these people and review the qualities required in my mind. You say, "Here is John Jones. Now he has handled thus and so and has experience very similar to what we need on this project." In this way you don't overlook people for a project.

Or instead of following route B (figure 3) he may follow route C:

> Each man is thought through before characteristics of people are compared.

And sometimes route A is used:

> We had a number of candidates in the back of our minds. We got the job lined up and then got down to cases to choose people. There were a goodly number of candidates and the first act was to eliminate the people who were too busy. So you look and find people who have come to the end of a job or who may be at loose ends temporarily--this probably narrows it down to two or three--maybe four people. Then you have got to go to work on the four to find out which one would likely do the job best. I do make a list and put numbers alongside the names and then start drawing lines through the names to get down to two or three. There are generally some practical overriding considerations for crossing out names--abilities for instance. Really what I think it boils down to is that I go through the names and look for reasons to cross the man off. You put down a list of candidates and at first all might appear to be equally qualified. Then the process becomes one of finding drawbacks to each person which gives you license to cross the man's name off the list.

And a series of excerpts from another interview covers this same ground and adds the interview processes:

> Take jobs within my group for instance. For any job that comes up there may be of the order of ten candidates whom you have to select from for a fairly large job. It is fairly easy to get this down to say three or four just based on past performance. Out of any group of ten people who can handle mediocre jobs, there are only two or three who can handle complex jobs--based on their past performance. Actually, I try to narrow it down to just one and then I try to interview the man. The group from which you select these people pretty well has established itself, because one of the requirements is that a man have a broad background which just plain takes time. In other words, you are not looking at people who have been here a year, you are looking at people who have been here for fifteen years. So you get it narrowed down to fifty people or something of this order. And you are looking among those fifty people for those who have shown leadership ability--who have handled groups or shown promise in their handling of other people. This may narrow the thing down. We are looking for types like the branch head or the section head, or people who have shown some amount of ingenuity or getting up to a job that demands leadership. This narrows it down even further when you are looking at it from that standpoint. And then this type of person may not always have the broad background I talked

about, he may be a detailed specialist--there are a lot of specialists who wouldn't (or couldn't) do this broad project management job. So eliminate the specialists who have been here fifteen years and this further narrows the thing down. The list changes from year to year--you are not always going to consider the same ten people. During this process, people in management talk to each other and a list of names is drawn up. I went through this whole process and I ended up with about four to five people and out of this I selected one man--no, on the other hand, I selected two people who I thought could do the job. And as it turned out, Mr. __ wasn't available as he had decided to take another job--so he was eliminated. But I had gone through this process--in going through it I talked to several people who came from my group who had worked for Mr. __ in project __.

In reading just these words, one gets a feeling that the process is almost described, but that it is elusive and perhaps not really there. Part of this seems to be due to the fact that there is in this description a bit of routes A and B which are mixed together. The interviewee sounds like he is going to follow a logical pattern, but he somehow slips from having a few people to suddenly having just one without being sure how he had done it. He either did not recognize or would not admit pre-selection.

Here are some data on the interviewing done:

I interview the man and find out whether he has an interest in this particular job and whether I feel that he would motivate the project. I find out if there is some personal factor in his life which would require that he doesn't travel or that he not put full effort into the job. If you find out that he does have the proper personal interest in the job, then he is the man--he is your candidate. If you find out that there is some doubt after you interview him, like the personal factor or that he doesn't have a particular interest in this type of job or if you feel that he doesn't want to push himself too hard right now, then you take the second candidate you picked. You don't interview all the candidates. If you start interviewing a whole list of candidates you tend to get the whole group stirred up. I think it is better to make up your mind prior to the interview (on which is the leading candidate) if you have enough facts from past performance on jobs--which is usually not too much trouble.

You insure your selection with an interview. You make sure that the man is willing and that he has an interest in the job.

> There is discussion among us of possible candidates before a man is interviewed. We don't just say let's select a man today--we start thinking about it well in advance of the date when the decision is required.

Not much more than has been presented can be drawn from the recorded interview data to indicate that the process is as it has been described in figure 3, but as I listened to the people talk (and some conversation was not taped or recorded in notes) I had the definite feeling of a pattern that was essentially as has been presented.

Some other points worth noting are:

> In general the people rejected for a job in favor or someone else just didn't have the required attributes in as high a degree--they just didn't have as much experience.
>
> You don't feel that you have picked the best man in the world for a job or even the "best man in the laboratory" but, only the best man you know.
>
> There are not so many gradations in people as there are differences. In a sense it is a case of the haves and the have nots.

Also I got the feeling that, even though there was no written procedure being followed, and in fact that it was mostly an unconscious pattern with conscious thoughts being only partially defined, there was a similarity to the process used by all of the decision makers. In their groping for words, a common pattern seemed to be discernable. It may be that I am imagining more than is there, but I believe I am right in thinking that I have uncovered a segment of truth. When one of the decision makers was asked about this feeling that there seemed to be a commonality to the selection pattern, he said that the biggest thing that he thought would create variability of the process would be the level of the project, even though procedures were not arrived at by mutual agreement. He thought that the procedures are arrived at on

an individual basis--adopted because the "idea seems right to me." And before leaving the idea of procedure commonality, it is perhaps worthwhile to wonder it it arises because the decision makers work with one another in a similar environment, working on similar problems with similar people. Perhaps this is a variation of the idea that married people tend to look alike after several years of marriage.

Attributes

The attributes desired by decision makers in project managers are largely described in their own words in this part of the chapter. A few of the descriptions are in terms of negative attributes; that is, in terms of why some person was not chosen for a job. It should also be noted that some people who were turned down for jobs were sometimes considered capable of performing them--only someone else was more capable. And of course, for certain jobs, the priority of projects was such that the "best" man for a job might be left where he was on another project.

The order in which the attributes were stated is not believed to be significant. Where there was some re-interviewing done, the interviewees often stated attributes in different order, and sometimes did not mention all attributes in both interviews--which is not surprising in the absence of formal, or even informal, written procedures.

The attributes seem to fall into Katz's three catagories of skills of human, technical and conceptual[17] and my expanded listing of

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[17] Katz, op. cit.

the skills in Chapter III. But here are some of the decision makers' words and the reader can perform his own summary if he desires.

> We are looking for a man with this broad background since he will be forced to make decisions across a number of disciplines. He doesn't have to be an expert in all of these disciplines, but he has to be able to know what experts to go to and how to weigh the opinions of these experts.
>
> Maybe he will not make the best decision with regard to say, electronics, or the best with regard to mechanics, but he will be able to make a trade-off between these two and come up with the best over all decision from all standpoints--and of course in this decision make the project progress.
>
> He will be forced to make these decisions with incomplete information. He can't always wait to get the best decision in some areas because his schedule calls for him to make a decision now. Now, if he feels that the job will be an order of magnitude better if he waits three months, then he obviously will wait three months. But if it is going to be one percent better, then he will probably go ahead right now because his schedule is also important. He has usually got to look at it from this standpoint and not from the standpoint of 100 percent perfection in every aspect.
>
> He has to have a contractual background. He must have the ability to deal with the contractor and motivate him. Now in some cases, motivation may be that he has a loud voice and shouts at the contractor; but, if this is what is required, he must recognize it.
>
> Has this man handled his project well and run it smoothly? Has he kept it within money and within schedule? Now a man might have a one hundred percent overrun on his job and he may be way behind schedule, and we may think that if he had been a stronger manager then this would not have happened. It may be that this result has not been entirely within his control, so you have to weigh that factor also.
>
> Do you think that he will strive to keep the thing on the straight and narrow path toward an end date with the money that has been set up without getting into a side research project that to him would be very interesting? He has to put those things out of his mind and push toward this one job.
>
> Can this man get along with people? Can he work with the project, motivate the project and keep some esprit de corps?
>
> Has he shown leadership ability--has he handled groups or shown promise of handling them from a leadership standpoint--both contractors' people and in-house people?

Mr. __ is probably as bright a man as any in the laboratory--he is a top research man. He deals with people and has been an excellent leader. But he has had no experience in his background in dealing with contractors. This meant that there was an awful lot this man would have to learn in a short time to negotiate the contract and get the show on the road. This is not something a man just picks up quickly. If he worked several months to a year on a smaller project working with the project manager, then he would be in a position to make an excellent manager.

I don't especially want a specialist, but any project tends to lean toward one speciality. So if the candidate has a speciality, it should be in that area.

You don't want a man who is going to tie himself up with the details of the project--who will do all the calculations himself. You want him to delegate the details. And you can best judge this by how he has handled other projects in the past.

You want to know if the man has drive.

One of the first things that comes to mind is whether or not the man is technically capable.

He has vision and imagination enough to decide as he goes along what needs to be done.

He really expanded the project over our original concept by a factor of two or three and this sometimes got to be a problem. But I think if you have a problem with a project manager you would rather have the problem of a man who is really enthusiastic about what he is doing and the problem of keeping him from going too far and too fast rather than worrying whether he was going to get done the job that was assigned to him.

But you are not always afraid of a man researching the problem to death. It depends on the type of project you are talking about. If it is a research project where you are starting something that has quite an element of unknown then you want someone who will develop ways to solve the problem even if the original scope is exceeded.

He was so enthusiastic about it that he was able to sell everyone who worked on the thing with him.

Mr. __ tends to manage a project in what might be called the classical manner. He has people who he figures are responsible for this and that and he depends on these people for his inputs. He isn't a technical man himself and doesn't claim to be. Therefore, I would have some reservations about his technical depth and knowledge. In seeing that all loose ends are taken care of he is very

good. So if you surrounded him with a good technical team, I'm sure he would do the job well.

In so far as actually taking his ideas and seeing what should be done and then seeing it through and managing it--getting those things done which need to be done and avoiding the kind of things that do not have to be done and would waste time--well, I think he is just not quite as capable in that respect as Mr. __.

I would have been bothered by the fact that he might be giving one the appearance of knowing and understanding what has to be done and of assuring me that the situation was thus and so when really it might be quite different. In other words, I think he has a feeling for a necessity of giving an appearance of assurance about the situation--whereas, I feel that if he is in trouble, we would kind of like to know about it. I think he sometimes gives a feeling of confidence when it is not warranted.

Mr. __ is a little too much of a hand wringer. He can see things going wrong in a big way and he occasionally needs reassurance that we will survive somehow.

He is technically well qualified and he always seems to know what needs to be done and he goes ahead and gets it done without going on any tangents.

He is always in there fighting--he gives the feeling that if we aren't ahead now, just wait until next week and we will be.

He is okay technically, but we have had past experience that he is just a little on the negative side so far as getting along with people is concerned. He doesn't ordinarily inspire people to want to follow him. So far as knowing what needs to be done and proceeding to do it, he does very well. But he has had a little bit of a history of alienating people somewhat.

Does a man have an aggressive personality, does he move fast? How well will he stand up under strain? How does he balance between the problems of: acting--then thinking, if ever, and thinking, then acting, if ever.

He seemed to have a lot of common sense. He seemed to put things in the right perspective. He didn't go off half-cocked. He didn't seem to get excited yet he seemed to have a lot of energy. I guess the choice was really made on more subtle things. He seemed to be a complete type of person. There were no obvious serious defects in so far as his abilities of getting along with people or getting work done were concerned. He seemed to be a well rounded person with a lot of common sense.

He had sufficient technical competence and he could get along with other people. Technical competence is a lot of things: knowing when people are giving him the "straight scoop" (this kind of relates to getting along with people), knowing when he might be going astray in an area where he doesn't have technical competence and calling in an expert, knowing how to judge when an expert is telling him the correct thing. He has to filter out some of the extraneous things the expert may tell him--and I felt that he had developed a pretty good filter.

He has trouble getting a group of experts to work with him in the direction of the project. You don't think of him for a job which requires that he organize the team and force his will upon it when required in arbitrary circumstances.

He was really on top of everything and he could talk intelligently. In any group, he could get up on his feet and express himself clearly. It was evident that he knew what he was doing. He was a very hard working guy. He could write intelligently. He could organize himself and his personal technical material and he could organize the work of others. Almost from the first time he came through the door he had someone working with him. And when he was supervising a junior person, he kept them hopping--and these junior people would remark that this was one of the best assignments that they had ever had. He had all the earmarks of a competent individual. Early in his work he did show one bothersome characteristic a time or two by talking off the top of his head when he didn't have sufficient basis for it at a time when he shouldn't have (sometimes you have to). After being called to task for this he seemed to get over it pretty quickly and this is no longer a source of worry--which is one sign of a good man--he corrects his mistakes when they are called to his attention.

Mr. __ is poor in his presentations--either written or spoken. He is well qualified otherwise--his only weakness is his manner of presentation to other people.

To be a good project manager, a man really has to be a bit of a philosopher.

You want a man who is technically conversant (or has the capability of becoming so) with the type of project he will manage. He doesn't need to be a specialist, in fact, you usually don't want one, but he should be at home in that particular sphere of activity. He should have the ability to assess the broad areas in which the project will demand activity.

He should have a capacity to work well and effectively with other people. He must know how to delegate major responsibilities--and when to delegate and when not to.

He should have enthusiasm for his project and be a kind of inspirational leader.

Mr. __ didn't have experience with the particular type of technical know-how required in this project. But he had run a major activity with remarkably few people and had shown that he was adept at administration. And he had all the other characteristics. Since he was lacking in this particular field, we picked a man who was an expert to be his assistant.

We wanted someone who had enough technical background to grasp the issues and who had had sufficient background in directing contractors.

He had shown judgment in working with contractors on previous jobs. He would know when to take a contractor's word on faith and when to check it.

The man must be a good engineer--a practical man. He must understand how to make practical judgments to arrive at a solution. But more than one characteristic defines this ability.

He must understand all of the factors of his project. He may not know them all himself, but he must know when and where to ask for help and how to interpret the answers in terms of a logical solution.

He must have a sense of the orderliness of things. There must be orderliness in procedures and in delegation of proper authority. He must realize that people can create chaos by not telling others what they are doing. He must be communicative and recognize the need for communicating.

He must be apt--quick to learn. Often the programs proceed so quickly that one just doesn't have enough time to mull questions over too long.

He must provide people with enthusiasm to work on the project. He must sell them on the program and on the intangible rewards associated with doing it well and quickly.

He must be a good judge of human nature and be able to understand why people are thinking as they are even if he doesn't agree with them. And as a special case of this, he must be aware of the contractor's position and why he is taking it.

One of the most important aspects, of course, is that the man must be technically capable.

Will the project manager recognize a pattern and will he get others to recognize it? The project manager is responsible for establishing this pattern. You have to find a man who is capable of doing

that.

For project __, Mr. __ was picked as project manager because of his managerial, not his technical, ability. He had technical ability, but not in this particular speciality.

Other Factors

Some special remarks apply where the training function is viewed as one of the needs when selecting a manager for a small project.

Here I think it was a case of taking a boy who was obviously a comer. I thought we should take a chance on him knowing that we could back-stop him if we had to.

This idea of taking a gamble on a man is always a strong component in cases of this sort. It is based on a subjective feeling of how the man is developing--and the point in time of his development. Is he ready? Does he have sufficient maturity and common sense?

I was looking for something I could challenge him with--a singular challenge. I wanted him to put up or shut up. He had indicated several times that he wanted more responsibility and I must admit I wasn't totally convinced he was ready for it. The gamble was in a sense larger on this job but again there was this back-stop idea. I am sure it never would have gone too far off course. It was not so much a gamble as an opportunity to challenge.

There are two sides to this gamble aspect. If the job goes charging on through and if the man doesn't hold his end up--well you have to back-stop it somehow. But if I put a man on a job and somehow it falls through for some reason that he is not responsible for--well then, I have wasted his time. These are the two things I worry about.

But in the bigger projects, training is not considered explicitly:

On bigger projects, the type of man chosen will automatically be the type who will grow and learn (at least if we have made a good choice). The training function is present in this sense but it is a definite factor in smaller projects. And sometimes a project might be chosen for the purpose of training the laboratory in a new way of doing things instead of the manager being chosen for training.

> The training function is not particularly considered in bigger projects. At this level, the person selected will just naturally grow. Training might be a factor on smaller projects where a man can get adequate support from his branch or division.
>
> You try to give the younger people a challenge in their jobs so they will have a chance to grow.

Another question was whether or not secondary factors are taken into account before or after a man is tentatively chosen for the job of project manager. A line supervisor might be selected to manage a project and if so, someone would probably be selected to fill his line supervisory job:

> On project __, his whole unit became one big project office--and this isn't the way a part of your line organization in any system should be set up. So I became determined as a result of this experience to keep special project managers and line supervisors separate.
>
> When other jobs are affected, the qualifications of the man are considered before any consideration is given to the second order effects. If the second order effects were considered first, nothing new could ever start.
>
> Second order effects are sometimes important. Mr. __ was considered for project __ but he was involved with many complex problems within his line organization. The second order effects then would have created more problems than having him as manager for the project would have solved. <u>But</u>, the second order effects are considered <u>second</u>.
>
> Changes are good in the line organization; they give people a chance to grow. Therefore, we usually don't mind changes in line organizations that are created by selection of a project manager.
>
> Now, __ could have done this job and done it well. But he was doing another job and he was just as valuable where he was; I would have had a hard time replacing him because I don't know anyone who could step right in and do the job as well as he is doing it.

The project priority determination will exclude some people. But this is a first order part of the decision. Once priority has been determined, second order effects do not affect the main decision

but become other selection decisions that are considered after the main decision is made.

Summary

Data obtained from interviews have been presented; these data provide the main basis for the procedures outlined in the previous chapter. All of the conversations could not be tape recorded and, in fact, it was not possible to take any notes in some of the interviews. Therefore, I was sometimes left with impressions and intangible "feelings" about how the interviewees were thinking. This was particularly true of interviews conducted after the first model of the procedure pattern had been made. There is the hazard that I was reading things into people's remarks, things that were not there. I do not believe this to be the case but if the reader has not acquired a general belief from the data of this chapter that the procedure as described in Chapter III is reasonable, then it is quite likely that I was.

CHAPTER V

TEST CASES

In order to test my understanding of the procedure used in selecting project managers and to obtain additional information, two case studies were created. One of these cases was given to four decision makers at the laboratory where the basic data were obtained; it was also given, in slightly modified form, to two groups of Sloan Fellows at the M.I.T. Alfred P. Sloan School of Management. The second case was given to one decision maker at the laboratory; this decision maker also produced a synthetic protocol of an actual project manager selection (that is, a re-creation was made of a conversation between this decision maker and one of his associates concerning the selection of the manager for a real project).

Test Case One

For the main test case, a hypothetical project which would be suitable for the laboratory to undertake was invented. Also, four hypothetical people were invented who were to be regarded as candidates for the position as manager for this project.

The project was essentially one of taking a developed hardware system and modifing it suitably for a different mission than that for which it was originally intended. There would be a small amount of research involved, of an applied rather than basic nature, but the main problem was one of development of a proven system for a new use. The problem was a systems one that required fairly broad experience although experience in one particular type of system was obviously

desirable, and there was a slight emphasis on one aspect of that system. The development was to be done primarily through a contractor, so contracting experience was desired. Other government agencies, and probably other countries, would be involved.

Some of the characteristics of the four hypothetical candidates are as follows:

Mr. A: He is in his early forties with BS and MS degrees, three years of military experience related to his field and about eleven years of industry experience. The last six years of his career have been at the government laboratory. He has had considerable systems experience and project work but in a somewhat different technical field than the main specialty required in the proposed project. Most of his government employment has involved work with contractors. He has had line supervisory experience and has shown good management capability.

Mr. B: He is in his late thirties and has a BS degree. He has worked at the laboratory for sixteen years. His background is in design engineering of systems directly related to the proposed project. He has taken many post-graduate courses related to his field of endeavor but does not have a master's degree. He has had line supervisory experience and considerable project experience, but the projects have been mostly "in-house" efforts so his experience at working with contractors is limited. He has shown good management capability.

Mr. C: He is about forty years old and came directly to the laboratory seventeen years ago after receiving his BS degree. His work has been closely related to the field of the proposed project but it has mostly been of a research rather than project nature. Under his line supervision, several of his people have been responsible for small projects. Also these projects have often involved contract work, though on a small scale, so he is conversant with the problems of dealing with contractors. He has been a good manager. He thinks that he has been running down in drive lately and believes that involvement in a big project would give him a new stimulus.

Mr. D: He is in his mid-thirties. He came to the laboratory fourteen years ago after graduating with a BS degree. He obtained his MS through extension courses three years after coming to the laboratory. His work has been in the field of the proposed project and he has had considerable experience at working with contractors. He has shown good management capability.

Additional facts and comments about these four people were provided in order to round out the story of their work experience and capability; most of these facts will become apparent when the comments of the decision makers on these candidates are presented. It was noted that, although all of these people were occupied at present, their assignments were such that other people could be found to take over.

I tried to describe the people and their histories as realistically as possible and actual events in the history of the laboratory were woven into the descriptions (although a few liberties were taken with history). The descriptions of the people were in part based on real people but deliberate distortions, both in favorable and unfavorable directions, were made.

The four decision makers at the laboratory were asked to study the project and people descriptions and to rank-order the four candidates in order of desirability for the position of manager of the proposed project. The idea of what was wanted was explained in person to three of the decision makers; the fourth was notified by letter in hopes that his description of how and why he chose would be less colored by detailed explanations.

The first question asked by the three decision makers spoken to personally was, "Tell me more about the project." Other questions and statements indicated a desire on the part of the decision makers to focus on the relative priority that this project would have in relation to other jobs at the laboratory and on the general qualifications that would be required of the manager. In other words, the reaction of the decision makers seemed to be consistent with the

process described in figure 2 (Chapter III).

The next questions concerned the manner in which the hypothetical people would be described to them. The decision makers were then shown a preliminary draft of descriptions of three people. The universal comment was that the information presented was insufficient and was essentially a verbalized version of a work history such as might appear on a job application form. They felt that the personalities of the people did not come through and that they could not get a mental picture of the man.

If one stretches his imagination slightly, it can be said that the decision makers had not had enough observations of the candidates to complete the process described in figure 1 (assuming that desired attributes had been stored in the decision maker's memory). And with just a little more imagination it can be concluded that the decision makers were saying that the process of figure 1 is followed before the final selection process of figure 3 is begun.

After this preliminary briefing, the descriptions of the hypothetical people were considerably altered and expanded to include such things as what other people had said about the man and his capabilities in order to try to fill in some of the gaps in the preliminary descriptions and to provide people with higher degree of "observations" for storing in "memory" before they processed the people through the final decision process. Inevitably, of course, the original processing of attributes and the final selection procedures would be telescoped to a degree in the decision makers' minds.

The descriptive material was transmitted to the decision makers

and while they were making their decisions, a prediction was made of how they would choose based on the attributes I thought that they desired in a project manager.

The prediction was that:

1. All four candidates would be considered as capable of doing the job: that is, none would be completely rejected.

2. All four decision makers would select Mr. D as their first choice. This would be based on the fact that he had the most technical experience related directly to the needs of the new project, that he had the most experience at dealing with contractors in fields most closely related to the new project, and that he had at least equal skill, if not more than the others, in other facets of management such as planning, human relations, and enthusiasm. In short, he would be essentially an obvious first choice.

3. All decision makers would rank Mr. C as the least desirable based mainly on the fact that he seemed to lack some of the drive and vigor required of a project manager and partly because his experience at dealing with contractors was minimal. Also, he would appear to be more suited for continued employment in a line supervisory position and should probably be promoted to higher positions on that route rather than through project management.

4. Two of the decision makers would choose Mr. B as second choice and Mr. A as third on the basis that Mr. B had a technical background that was directly applicable to the new project whereas Mr. A's technical background was in a somewhat different field. These decision makers would weight technical competence in the correct field fairly heavily. They would consider the fact that Mr. B had less experience in dealing with contractors than did Mr. A as less important than the technical competence. They would feel that others in the project office could help Mr. B with any deficiencies in his dealings with contractors, particularly since Mr. B did have some experience in this line.

5. Two of the decision makers would rate Mr. A as second choice and Mr. B as third for essentially the opposite reasons. They would weight the experience of Mr. A in dealing with contractors very heavily and would think that Mr. A's inexperience with the immediate technical problems could be overcome by specialists on his staff since Mr. A did have a good general background.

The predictions failed, at least in part and where they were correct seems to have been due less to keen insight than to circumstance:

Decision maker	Predicted ranking	Actual ranking
1	D B A C	D A B C
2	D B A C	D A C B
3	D A B C	D A B *
4	D A B C	D A B C

* C completely rejected.

The biggest reason for the incorrect predictions, and why I have less than joyous enthusiasm for the correct predictions, seems to have been in the way A's and B's abilities and characters were interpreted by the decision makers. Mr. A was evidentally regarded as a more forceful and strong person than had been intended and Mr. B was regarded as less strong than I had thought I had pictured him. The mental picture I had of the men when I was describing them evidently did not come across in the written material. Instead of A and B being found almost equally qualified, the decision makers found A to be obviously better.

A strong case cannot be made out of the difference between the rankings of decision maker 2 and the other decision makers since decision maker 2 said that he regarded B and C as nearly equal choices and that with further thought he might reverse the order (thereby ending up with a ranking of DABC as did the other decision makers).

Perhaps a decision maker's actual words describing why he chose as he did will shed some light on the overall decision process:

First I noted that all candidates were about the same age and had BS degrees except for D who was a bit younger and had an MS degree and A who also had an MS degree.

Reviewing A, I noted that he has a very good background in practical experience. He is apparently a dynamic individual who tends to leave a job that has become static and go to another where there is more action--I think this would be a point in his favor on this new project. He also has shown abilities to start with a small group having a rather poorly defined assignment and make something worthwhile out of it, to work with "different" types of outside groups, to maintain morale and enthusiasm of subordinates under difficult conditions and to develop people as well as hardware. While his technical background doesn't appear to be directly applicable to the new project, I don't see anything which would make me have a serious doubt as to whether or not he could handle the job. Since I think one of the important requisites for this job would be an ability to get along with people, particularly those outside the laboratory, his abilities in this line would be a very valuable attribute.

The first thing I notice about B is that he is generally a quiet and comtemplative person; which are good attributes in a research man, but this would not help him much as a candidate for manager of this project--unless I find that he has also shown outstanding ability to work with a lot of people and to get things done.

After finishing reading the description of B, I find that he sounds like a pretty capable man. But I would be rather cautious in assigning him as project manager. His tremendous amount of design skill and experience do not seem to be required and he has not had a lot of experience at dealing with contractors. I think he would be an excellent member of the project team and I would give him primary responsibility for design phases; he doesn't seem desirable as manager for a project where he would have to deal with different groups having different interests and located in various parts of the world.

C sounds like a fairly capable man. My first impression would be that he would be a better line organization man (perhaps even at a higher level than his present job) than he would be as manager of a project like this one. I was a little worried about his appearance of being lackadaisical and easy-going. But he seems to have become aware that perhaps he has developed a tendency to become too set in his ways and that maybe he should try something a little bigger and more challenging. If I felt that he was sincere in this feeling, and if I were certain that he hadn't grown too accustomed to moving a little bit too slowly, then I would consider that he could handle this project very satisfactorily. I doubt that he would be as aggressive in running the place as A; but, he sounds as though he would be a mature enough man to see

that the job was done--particularly if he were supported by an adequate staff of younger, capable people.

D is a little bit younger than the others but I won't attach any significance to that until I find out more about him. He seems to have varied his field of activity somewhat from time to time and thus he has managed to keep himself involved in something new and challenging. He seems to have had some pretty good experience with other government agencies and laboratories. He has kept his current project office small and this is something in his favor. He is able to maintain the morale and enthusiasm of the people working for him even when the going is rough. Also I give him credit for realizing that the latest idea he has been pushing actually isn't too worth-while and having the gumption to say so rather than continuing to push it simply because it is his own idea.

Having read all of the descriptions, I conclude that two men sound pretty good, A and D. So now I will review the descriptions.

After reviewing, I conclude that both A and D are well qualified and I would have some difficulty in trying to decide which would be the better man. In a real decision, at this point I would begin to look for things not included in the description--such as the people's health and home situations since this job might be rather demanding and require a lot of travel and so forth.. Also in a real situation, I would forget about it for awhile, sleep on it and review it in a few days. Also, in the meantime I would sound out a few more people to find out what they thought about these two candidates. As of right now, A or D would be my first choice, the other would be my second, and C would be the third choice provided I was convinced that he was really serious about getting into high gear and going fast to keep up with this project. My last choice would be B because I think his in-house type of experience would not qualify him for this large project; although, I would certainly try to put him on the project office staff. Also, I would not put both A and D in the project office, they are both too much of leaders on their own.

Now, several days later, without any conscious thought on this meanwhile, I have re-read the material. Based on the information presented, I would pick D for the job since he sounds almost perfect for the job. He has had the right type of technical experience and he has had experience in running a project office and he knows what to do, particularly since he seems to have made some mistakes and profited from them. He also seems to know the difference between managing a project which will be done mostly by contract and trying to do it all in-house. A's experience is just a little different. I believe there is every indication A could do the job, but not as well as D. A sounds very good but D sounds almost perfect for the job. My third and fourth choices would be B and C respectively.

This foregoing description provides, I believe, a reasonably good confirmation of the overall decision process as described in Chapter III. The picture is somewhat distorted since the manner in which the test case and people were presented to the decision makers made it essentially impossible for them to follow the procedure in detail. But, it seems that this decision maker came close, and was probably trying unconsciously,to following the procedure.

As previously mentioned, the initial presentation of the hypothetical problem to the decision makers involved the project definition phase. Then, the actions of this decision maker in his first review of the candidates can reasonably be considered to correspond to the observation and storing away of fact phases. The initial remarks above imply a quick reading of the opening paragraphs of the four descriptions to get a "feel" for each man. The remarks he made, prior to laying the problem aside for awhile, seem to correspond to the observation period--although the "observations over a period of time" are compressed to a few minutes of time in reading a few paragraphs of material.

After laying the material aside and mentally storing the data, the final choice of the decision maker was made. It seems that the decision maker is trying to follow route A of figure 3; that is, he is considering the attributes of each candidate and coming out with a rank ordering of their desirability. There is an element of at least partial pre-selection (of candidates A or D) but one could say that route A was still followed at least to the extent of selecting between these two candidates. It is interesting to note that there was evidentally

a change in what could be called the total pre-selection rank-order in that, in the final ranking, B and C were in reverse order from the preliminary selection; evidently the decision maker decided that C really had not converted sufficiently from his easy-going ways to a man of action.

The remarks on what the decision maker would do in a "real" situation lend some credence to some of the other steps in the model of the process. Also, there is additional information on what some of the attributes are that this decision maker desires in a project manager.

Some of the remarks of the second decision maker were:

> First I read the material. And I noted that one problem would be that I did not know the people as well as I would in real life. But I tried to evaluate the people on a total picture basis.
>
> A and D were rated almost equally. Both are leader types. They would institute esprit de corps. Both are what might be called worldly and are much alike in this respect. I considered D to be the best for project manager because I read the project as one requiring his type of experience more so than the type of experience and orientation that A had. It was hard to choose between them. They were both very much alike in being able to deal with a variety of situations and people.
>
> C is doing a reasonable job as a line supervisor and it does not seem desirable to trade a good line man for a questionable project man--particularly since C has never done any project work. C seems mostly to want a change of scenery. If he is really going to change, he should do so at a lower level than project manager. C seems to lack some of the broad leadership skills and the variety of experiences desired in a project manager. C can implement once he is given an idea, but the project leader needs to be more idea generating himself.
>
> B gives a sense of passivity that would not be compatible with project needs. If he were given a problem, he would respond and respond well, but he doesn't promote leadership--he doesn't make things happen. And, he seems to be lacking in contract and field type experience. He works hard and is competent, but you wouldn't look to him for a blaze of leadership. He would command respect because he is competent and works hard, but not because of leadership abilities.

But none of the four could be completely rejected. If A and D were not available, then B or C could do the job. A and D don't seem to have any weaknesses. D is preferred because his technical experience fits in best with the project needs. I would pick C third but this is rather subjective. If I thought about it again in a few days I might pick B ahead of C. B and C seem more like line supervisor types rather than project managers.

I feel that I don't really know these people well after reading the material. In a real case I would have associated with them for many years and would have noted many things about their behavior that can't be obtained from just a brief write-up.

The procedure I followed in making my decision was to first read about the project and get an idea of the general needs. Then I read about the people and made brief notes about pertinent points and factors--essentially the points mentioned in the foregoing. Then I reviewed the notes in the light of the project needs. Then I picked the man best suited.

It seems reasonable to conclude that this decision maker is also following the procedure of Chapter III and he is using path A (figure 3) for his final selection. Because of the way in which the case was presented, he has difficulty in following the procedure--in large part due to the fact that he hasn't had opportunity to observe the people and get to know them over a period of time which has tended to short circuit a part of the process. (Obviously he doesn't know the people; but it is likely that this decision maker also is bothered by his inability to completely follow his unconscious selection "routine".)

The third decision maker provided these comments:

I selected Mr. D as my choice for project manager. This choice was made immediately after reading the four resumes. I tried to use approximately the same process I would use in an actual case. First I determined that all four men were available. Then I looked for the man who had demonstrated successful experience which most closely approaches that which the new project requires. I recall in reading about Mr. D that I was impressed by the following items in this order:

a. Broad experience (technical and contractual)

b. Forcefulness
c. Commanded respect of project personnel and contractors' personnel
d. Demonstrated personal administrative and technical capacity and ability to recognize talent by completing job with a few key people
e. Not exclusively a detail man

In an actual case where I am personally acquainted with the candidate, these thoughts would probably not have occurred to me in this particular order but would have formed an instantaneous mosaic image associated with the man. (They only occurred in this order here because I was reading them for the first time.) Based on this stored mental image, when comparing candidates, I usually conclude that "X" is the best man for this job. Of course, this data which I have stored on these people is based on past contacts and experiences. Many of the actual experiences are long forgotten, but leave an integrated image which is retained.

Mr. A was my second choice. He placed second mainly because his total experience is somewhat narrower (in the scope of the jobs he has handled in comparison to D). Also his technical abilities and experiences are narrower than D's. His contracting experience is good but limited in all cases to a different type of systems than are required here. However, he would probably handle the assumed project well. I would not have too many qualms about picking him.

Mr. B's resume showed only one item which would prevent me from selecting him as project manager, and this was his lack of contract experience and direct project management experience on contract jobs of this scope. If I wanted to assure the best team, I would push for B as the assistant to D.

Mr. C is unacceptable to me as a project manager on a job of this size. He would make an excellent staff consultant for the project office. He is a lackadaisical plugger who has found the niche in which he fits best. Leave him be or find a staff type job for him.

After the project was defined (in the initial discussions), this man tended to use the descriptive material as a substitute for the "observations over time". He then used the pre-selection process in his final decision to pick man D and then used the material provided in the descriptive material to justify this selection. Since all of the decision makers chose D as their prime candidate, it is not too surprising that a pre-selection process would choose the same man. This fits

in with a statement that was made earlier--pre-selection is not necessarily a "bad thing".

The fourth decision maker made several comments relating to his understanding of the project (that is, he went through the project definition phase). Other comments by him were:

> As a preliminary selection process, all candidates possess several of my requirements to essentially the same degree; namely, organizational ability, ability to work with others, and ability to delegate responsibility among others. The choice then narrowed down to two prime factors--overall experience and personal drive.
>
> In technical experience, all are capable; but the overall systems experience of Mr. D gives him an edge, the particular experience of Mr. B rates him second, the hardware and field operations of Mr. A are valuable (but a little narrower) so I rate him third and Mr. C has had little direct operational hardware experience so I rate him as last.
>
> In contractual experience, the order of things is a little different. Again Mr. D is first because of his broader contractual relationships, Mr. A is second, he has long exposure to both sides of the game but his narrower area of interest makes him second, Mr. C is third because of his general experience, and Mr. B is fourth because of his almost total lack of applicable experience.
>
> In personal drive, the candidates fall in two groups. Mr. A and Mr. D have considerably more than do Mr. B and Mr. C. As a matter of fact, Mr. C just doesn't seem suited as a project manager since a project manager requires a short time exploitation of personnel potential, not long term development. He has slowed down technically, socially and in all general respects. Mr. B potentially has drive but seems to rate himself as the eternal number two man. He needs a little more confidence and personal salesmanship.
>
> Mr. A and Mr. D are both strong in personal drive; both are energetic and good hard salesmen. Mr. A has played the opportunist by job hopping to some degree, while Mr. D has remained with the laboratory throughout his career. All these things considered, my ranking would be DABC.
>
> Success of a project is more important than meeting schedules. Prior to undertaking the project, we would have already evaluated the problems to determine whether or not we have the capability of obtaining success. Personal experience with the candidates would give me more depth of information concerning all four of them than

could be put in the write-ups. For instance, this depth of information would have given me more insight concerning the aptitudes of Mr. B, who has a good technical background, and it is possible that the aptitudes of Mr. B might have been such that I would have selected him as project manager. If the project were big enough, I would consider the possibility of making Mr. B assistant project manager.

Again it seems that the procedure is, in general, verified. Perhaps route A of figure 3 (the final choice process) should be modified so that instead of having all of the attributes of each candidate being considered separately, there should be an alternate path, A', which has each candidate being measured in order against a particular attribute.

Test Case One, Phase Two

Since I was certain after the initial interviews that I had found a structure which reasonably accurately described the decision process, it was suggested that it might be interesting to use the same hypothetical case and hypothetical people but for a different purpose. The hypothesis that would be investigated would be that following a systematic procedure for the decision process would give different results, in the final selection, from a decision reached by following no particular process. Accordingly, a slightly modified version of the case that was given to the decision makers at the laboratory was given to twenty-one Sloan Fellows at the M.I.T. Alfred P. Sloan School of Management; ten of these new problem solvers were to follow a simple plan for selecting and rank ordering the candidates and the other eleven were given no plan at all to follow.

The plan was designed primarily to allow A, whose technical background was "obviously" less suitable for the project, to be accept-

able on the basis of being able to be supported technically by a project office staff. It was also designed to tend to reject B, who was "obviously" more qualified technically, on the basis of his lack of contractual experience. Needless to say, this test case was sent out before the results of the test cases sent to the laboratory were obtained; I did not know yet that the public at large would have a tendency to see less value in B than did I who invented him, and conversely, more value in A.

When the choices were all made and the candidates ranked, the results were as follows:

Ordering of candidates	Times chosen by those: Following a procedure	Not following a procedure
DABC	2	2
DACB	1	1
DCBA	1	0
DBCA	1	1
DBAC	1	1
ADBC	1	2
ADCB	2	1
ACBD	1	1
BADC	0	1
ABCD	0	1

There are no obvious patterns or differences emerging that would distinguish the results of those who followed a plan from those who did not. (Nor did technical background of the decision makers provide any basis for comparing choices.) The hypothesis that people following a plan will choose differently than those who do not was not proved (but also the results do not prove that there will be, in general, no difference in selection when a plan is followed).

Most of the comments made by the Sloan Fellows concerning this test were along essentially the same line as comments made by the deci-

sion makers at the laboratories. Some of the different comments were:

I think all four could do the job so I choose A first, largely on the basis of his age. He is older than the others and should be promoted on this basis; the others are younger and can wait. Also I think the project might not be sufficiently challenging for people of D and B's caliber. (Rank was ACBD. Was given plan to follow but evidentally did not do so.)

B's strong point is his excellent technical knowledge--and he seems to know how to apply it. His weak point is his contracting experience. A seems to lack technical knowledge in this field. (Ranking was DBAC. Was given plan to follow.)

B's strong points are his abilities to communicate, recognize his own weaknesses and use available talents; also, he has a good back ground of technical experience. A's weakness is his limited "systems" experience. (Ranking was DBAC. Was not given plan to follow.)

C's strong point is his ability to coordinate diverse activity. B has the abilities to develop people and to coordinate diverse activities. B and C are about equal and under some conditions I would reverse my ranking. A's weak point is that his specialized knowledge is in the wrong field. (Ranking was DCBA. Was given plan to follow.)

I believe any of the four could do the job in question. It is a matter of which would be the most desirable. A has broad past experience, but in the wrong field. C can complete unglamorous jobs but he hasn't had big project experience. D has appropriate technical experience, but it hasn't been diverse enough. B can coordinate diverse groups, but he lacks contracting experience. (Ranking was ACDB. Was given plan to follow.)

The salary level of the people influenced my choice. I didn't think the project demanded high salaried people.

I believe that D is really the most capable, but he is too good to waste on this project.

And we haven't met these people face-to-face, which also counts.

D's apparent talents and imagination would probably be put to better use outside of this apparently routine project.

I tried to fit the people to the test procedure but I would think that many other characteristics and qualities would have to be considered. Rather than a yes or no on the test, you would have to weigh relative strengths.

Those who did rate B high and A low evidentally did see in

these people the characteristics that I had intended. But from other comments and remarks it is also possible to conclude that they read the descriptions more hurriedly and less studiously than those who did not see these differences in A and B.

Additional comments on the hypothetical candidates were made by several people in a manner that gave one the feeling that these selectors were trying very hard to "observe" the candidates and "store" data about them.

It is also interesting to note that some people were rejected for the project on the basis that they were too good. This fact indicates that the project priority test and definition phase are not unique to the government laboratory decision makers. The desire for further knowledge of the people (face-to-face encounters) and the need for weighting factors instead of using a simple yes-no answer also have been suggested before.

Therefore, in general, although the hypothesis concerning the effects of following a procedure versus not following a procedure in selecting managers was not proved there was a certain measure of serendipity in this test case in that I did obtain some information that tended to confirm the model of the selective process.

The Synthetic Protocol and Test Case Two

A synthetic protocol was made of a conversation between a decision maker and one of his associates who were discussing the selection of a project manager for a small project for which their group would have management responsibility. The protocol was synthetic in that it was a re-creation after the event by one of the participants.

But both participants stated that it was a reasonably accurate reproduction of the conversation.

In the protocol it is fairly obvious that two things have happened prior to the conversation. First, the people in the group have been observed and facts about them have been filed away in the mind of the decision maker. Second, the project had been discussed before and an idea of the type of person required to do the job of project management had been more or less decided upon and the relative importance or priority of the project had been established. It should be noted that this was a small project, but, by the definitions in Chapter I it was still a project.

The entire protocol is concerned essentially with only the comparison of candidates in the final selection process. It is fairly obvious that some interviewing and discussion of the final choice still has to take place. The method used is essentially route A (figure 3) but some hints of pre-selection are included in that two candidates are discussed before a list of all people in the group is gone through person by person. One of these two people is the final choice (partly by default in that people who would apparently be better choices are on higher priority assignments) and the other is eliminated during this review of all the people. Some of the reasons for elimination of people will be discussed shortly.

This decision maker subsequently was given a second hypothetical project for which he was to select a manager. The project was different from the previously discussed hypothetical project in that it was smaller and more obviously a project which would be likely to

be assigned to this decision maker's group. At his suggestion, the actual people in his group were considered for the position of manager rather than hypothetical people.

The decision maker said that this appeared to be a type of project in which he would desire his group to be involved. He then asked for clarification as to how he had been asked to do the project; that is, he wanted clarification as to its probable importance or priority. Then he stated that he had an idea of how important the project was likely to be, and that he thought that it was a worth-while project for his group. He said his next step ordinarily would be to assign a man to the job for further study and that if the proposal did indeed become an actual project, then this man would be his choice for manager.

His selection process would either be to just consider two or three people he thought could do the job or go through the entire roster of people in his group for a complete review; the latter procedure was adopted in this case. As the decision maker was going through the roster he remarked:

> I seem to be rejecting everyone--I guess I am looking for reasons to reject people rather than to accept them. I sometimes do this when I consciously review the whole roster. Some of the men could do the job if we really had to do it. On a second cut I'd go through with different standards and come up with a compromise. One of the things I would have to do would be to consider how hard I wanted to do the project. I might turn it down. I'd have to puzzle over that a bit. But this project sounds interesting, so I'd probably go over the list again and see what my reasons were for rejecting people and see if there is anything I can do about the reasons--like back-stopping people with weaknesses or reconsidering the priority of jobs.

In both the synthetic protocol and in the hypothetical project decision the reasons why people were rejected fell into the following main categories:

1. Too busy with a more important project
2. Not the right kind of technical background
3. Insufficient technical and/or human skills for a project manager
4. Not interested in doing this kind of work (usually the person was one who was interested in theoretical research work rather than project work)

Only a few of the comments will be listed in detail:

He is good at theoretical research jobs but he doesn't like to deal with the real life implementation of getting things done.

Now he is a possibility. He is bright-eyed and bushy-tailed, aggressive, smart, poised--he can get along well with people. What's wrong with him? Well, he is just not as advanced as he should be on the technical side of the business as well as the procurement part.

I could recommend him but he is already tied up in a similar type but more important project. Why would I recommend him? He gives you confidence when you are talking to him--across the board confidence in technical, management and people areas and in his ability to integrate the whole machinery that gets things accomplished. He understands all interfaces of jobs. He is cool and steady. He has several years of experience and he obviously has kept on developing all this time.

I'd have to reject him. He just doesn't seem real savvy in a broad sense. He lacks aggressiveness. He would not know how to set up the total project machine; he just isn't the leader type.

He is acceptable but he is busy on another project. Also he does seem to be somewhat lacking in what might be called the take-charge ability. He is a little passive there.

He just doesn't seem to have the total integrated know-how required. He has all the personality attributes and he has common sense. But he needs more experience and more interest in acquiring experience.

He is just a different breed of a cat than a project manager. He is a long-hair researcher.

He just seems to have a complete naivete about the real world of business and people. He has the total brains necessary otherwise, but I'd have to reject him.

He is too much of a perfectionist--he just doesn't realize that on a project he would have to make day to day compromises in order to get his work phased with others.

I'd recommend him except for a conflicting assignment. There are

no negative things in the list for him. He's smart and has a good technical base to draw on. He works hard and he can organize himself and his work. He inspires confidence in other people about himself and his decisions. Historically he has produced.

I'd reject him on the first cut on the basis that he can't develop in other people a sense of responsiveness to him and confidence in him. Other people just don't respond even though there doesn't seem to be anything in his total person that you can easily put your finger on for the reason. He is pleasant and polite but there is something you look for in a leader that he just doesn't have.

He is too new and inexperienced and too junior.

The decision maker followed route A and found all people were rejected. After recycling through the process with changed standards, four people were selected; 1, 2, 3 and 4.

Man number 1 is a bit fussy but he will be dealing mostly with outsiders and his ability to get along in polite society might offset his weaknesses. He won't have to be running a large rough tough crew--where he couldn't do the job. Man number 2 is busy but perhaps his business could be taken care of by starting into this new project somewhat slowly and starting to phase him out of his old activities--one of his assistants could get ready to take over. Now about man number 3, I have some trepidation. He ought to do something like this project. He has the technical ability--but I think there'd be too much discussion of how to do it--I want someone who will just go ahead and do the job. Actually, I think a similar thought really eliminates man number 1 also. Now man number 4 has had his work load arranged so that he could be broken loose for something like this. He would be on top of the job. But I think I will save him for something more ambitious. So it reduces to man number 2.

Now I think I have been cold blooded and logical but I will have to think it over and review and see if I may have done something stupid or illogical. I'd really spend some time on this, but for now I'll describe some of the things I might think about.

The project will have certain types of technical paperwork and procurement problems. There doesn't seem to be a mismatch here. There are no great problems. The man is adequately qualified but not over-qualified. I haven't sent in a heavyweight boxer to do a babysitting job--and I haven't disrupted too much other work for this new job.

Then there are questions such as: Are we being fair to him in his professional development? Could he get a promotion two years

hence? It would look like he could, depending on how well he did. Would I be embarassed to explain the project to him? I think I could explain it OK--it ties in with the general type of work the laboratory is doing these days.

Now if for some other reason (such as illness) man number 2 could not be chosen, then I would probably choose man number 1 since I would like to save man number 4 for bigger things. However, if the priority of the job were raised, if, for example, there were a strong request from higher levels to do the job and they placed a higher priority and importance than I have now assumed, then man number 4 would probably be given the job.

Summary

It seems logical to conclude that the data from the test cases add weight to the idea of reasonableness of the description of the selection process as given in Chapter III. The material presented in this chapter adds to the understanding of this process and it does not indicate anything that would make one believe that the process is not as it has been described.

CHAPTER VI

CONCLUSIONS

The Problem Studied

The question examined in this study is whether or not the process of selecting people for the job of project manager in a government research and development laboratory is sufficiently understandable and describable that a pattern can be found to this process. Another way of stating the question is to see whether or not it is conceivable to view the process as one which can be programmed for data processing machines. The concept of programming the process is used to indicate a level of understanding of the process and not in the sense of advocating that it necessarily would be desirable to actually program it.

The idea of testing one's understanding of a decision process by considering if it can be described by a program was promulgated in a pioneer paper by Newell, Shaw and Simon.[18] They were among the first to advocate this engineering approach, as distinguished from a philosophical or social science approach, to an examination of the decision making or problem solving process. In this paper they examined the thought process of humans in solving problems in symbolic logic and found that this process was sufficiently understandable to be regarded as one which could be programmed. Among others using this approach to study the decision process was Clarkson.[19] He investigated the deci-

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[18] Newell, Shaw and Simon, "Elements of a Theory of Human Problem Solving", op. cit.

[19] Clarkson, op. cit.

sions of a trust officer in a bank in selecting investment portfolios; this decision process was actually programmed in a very successful computer simulation.

In these studies, the "items" considered by the decision maker were somewhat tangible and could be considered, at least loosely, as being reducible to numbers. The prime question when this study was started was whether or not similar procedures would yield fruitful results where the "items" considered by the decision maker are people, and where each selection or decision seems to involve many new variables, both technical and human.

Several decision makers at a government research and development laboratory were interviewed to determine how they, in actuality, select project managers. Hypothetical cases were used to obtain additional data.

Results

It was found that there is a common pattern to the decision process used by these interviewees. Hence, it is concluded that the process of selecting project managers can be understood and described; or, that, in the broad sense, it can be programmed. Based on the data obtained in the interviews, a model of the decision process was constructed. A detailed description of the model is presented in Chapter III. The main elements of that model are as follows:

A. There is a phase of observing people perform in their jobs which generates two lists: a list of the attributes desired in a good project manager and a list of people which rates their abilities against these desired attributes. These lists are generated more or less independently of the actual selection process for any given project.

B. The first active element in the process of selecting the manager for a project is the project definition phase where such items as the technical requirements of the project, the project priority and the general qualities required of the project manager are decided. This phase also offers a possibility of rejecting the project on various grounds.

C. The final selection phase consists of matching the project needs against the abilities of people who are available for the job of project manager and selecting the best match of these items.

In the model of the process shown in Chapter III these phases are broken down into more detailed steps. The model is in the nature of a flow diagram and I believe that it could serve as a basis for simulation of the decision process.

It should be noted that the entire selection process is carried out largely subconsciously on the part of the decision maker. Even those steps that are conscious are not executed in any formal fashion.

The attributes desired in a candidate for the project manager job are reduced to a fairly small list and can be listed under catagories of technical, human and conceptual skills. The ranking of people on desired attributes is done by means of informal observations of how they have performed on past jobs and not through formal methods. The project needs are defined before specific people are considered for jobs. There is an element of "pre-selection" in that there is frequently an immediate matching of one candidate's attributes with the project needs upon completion of the project definition phase. The rest of the final selection phase then consists of a more or less routine check to justify this initial selection.

There is a strong tendency for the decision maker to consider only his "own" people for a project manager job and if none of his own

are qualified (or are unavailable because they are on jobs having higher priority) he probably will reject the project. Secondary effects, such as other changes in the organization required as a result of selection of an individual as project manager, usually do not interfere with selection of a man if he is otherwise the best qualified. For smaller projects, the training function is often an element in project manager selection.

The elements of the selection process were all expressed in varying ways by the decision makers interviewed. But, there is a common pattern to the process in spite of the fact that the process largely is carried out subconsciously. And, even though the attributes desired in candidates reduce to a list that sounds rather noble, it was obvious, during the interviews, that the words had definite meanings to the decision makers.

The data from the test cases provided a further check on the model of the decision process. A hypothetical project was invented along with four hypothetical people who were candidates for project manager. Four decision makers were asked to describe the thought process they used to rank order these candidates in desirability for the management job. These descriptions were not in conflict with the model. Similar results were obtained with a second test case given to one decision maker.

A prediction, based on the model and interview data, was made of how the decision makers would rank the hypothetical candidates. This prediction failed, at least partially. However, I believe that the failure is not due to lack of validity of the model but is due to problems with my description of the candidates. I had tried to

describe subtle differences in the candidates which would allow different decision makers to weight the candidates' attributes differently so that various rank orderings would result. These subtle differences were evidentally too subtle; the ranking of the candidates seemed to be obvious, and the same, to all of the decision makers.

The same test case, but with a different objective, was given to a group of Sloan Fellows in the M.I.T. Alfred P. Sloan School of Management. Half of this group were given a simple formal procedure to follow in ranking the candidates and half were given no procedure. The idea was to test the hypothesis that those following a formal plan would rank the candidates differently from those who had no procedure to follow. No significant differences were found. I believe that this result does not invalidate the hypothesis, but that it provides additional evidence that the descriptions of the candidates made them appear to be too unequal in abilities. Also, I believe that the formal procedure was too simple (it was based on the model but greatly simplified).

Should the Process be Programmed?

Although I believe that the process of project manager selection could be programmed, I do not believe that it should be.

I believe that time spent on gathering information about people and about projects and on keeping this information up to date would be enormous. And the problems of actually writing, checking out and correcting the program would be long and difficult. It is not likely that it would be found efficient from a man-hour point of view to

actually give the job of project manager selection to a computer. Management would probably find itself spending more time giving inputs to the computer than it now spends in this type of decision.

However, my main objection to programming the process is that someone might be tempted to rely solely on computer outputs and/or formal tests of candidates' attributes for his decisions. I believe that such reliance would result in a process that would be both inadequate and unfair. Until we know more about what are the important elements in the process, we must continue to have the decision maker's judgment as an important part of the process. But, I also believe that the present method of selection could be improved by adding some formality to the process and that there are experiments which could be performed which would improve our understanding of the process.

Some Suggestions for Further Research

One of the things that should be done with my description of the decision process is to check with the actual decision makers as to how well this description matches their notions of how they are making decisions on project manager selection. This was done to a limited degree, and with no significant disagreements. But, problems of obtaining unbiased data, and other logistic problems, made it impossible to check with all of those interviewed to obtain detailed comments on my deductions as to the process being used.

Another possibility would be to actually write a computer program using my model as a basis for the program. I have noted that this

could be done and also that I believe that it would be an unfruitful exercise. A successful computer simulation of project manager selection would offer additional proof that the process is understood but it seems that it is unnecessary to provide this additional proof and that further details of the process could be better understood by other types of research effort.

An immediate, and probably rewarding, application of the results of this study would be to use the results as a basis for adding more formality to the present selection process. Since the process of project manager selection does contain elements of an understandable pattern, then it seems reasonable to conclude that the process could be improved by serious attempt to make the process less unconscious and informal. A degree of formalization, well shy of actually programming the process for a computer, could yield dividends in allowing decision makers more time for use of their human value judgments in this and other decisions.

At the very minimum, it would seem that the selection process could be routinized at least to the degree of establishing a check list or outline of the things to be considered in making a selection, such as attributes desired in candidates. This outline probably should be supplemented with a reasonably formal written statement of the project needs for each specific project considered and a written list of potential candidates for the job. This formalization should have as its objective the assurance that no major item or no potentially qualified candidate were overlooked in the selection process.

A check list could have other advantages besides "tuning up" present decision makers' thought processes. It could serve as an aid

to a junior executive who is just starting a career which involves selecting other people for various managerial tasks. The check list could help him form his own value judgments by giving him some idea of the judgments used by others who are more experienced.

Another area for study would be to re-interview the decision makers and see how they make decisions to promote line supervisors and determine for example, if the project definition phase is replaced by a job description phase (with everything else remaining essentially the same) or whether the pattern is markedly different. Along the same line, one could study the process of project manager selection in other laboratories, both government and industrial and see how similar the process is to my model. Or, going in a slightly different direction, one could see if there are similarities in the decision process when the decision concerns activities outside of the job environment--such as in selection of a wife, a house, a new car, or which television program to see tonight. And, in this type of decision, one could examine the differences, if any, between the process used by decision makers employed in research laboratories and the process used by decision makers whose employment is in a field where education and interest are likely to be quite different; for example, where the decision maker is a grocery store clerk.

Further study is also needed to determine the influence of prejudices for or against certain types of people in project manager selections. Prejudice generally either will not be admitted or recognized. So one skilled in psychology would have to examine this question. Such skill might also be required to determine whether or not some project

managers are selected in response to political pressure instead of the real needs of the project.

Another possibility would be to repeat, with appropriate modifications, the tests to see if a completely informal approach to decision processes gives different results than a formal approach. Two possible methods for modifying these tests are:

1. Make the relative strength of all candidates more nearly equal so that there could be a more random choice for those who had no formal procedure to follow. Those who had a formal procedure would then have to be given a detailed plan that would pick out more subtle differences in the abilities and experiences of the candidates and force selection of a man based on whether or not he had this subtle attribute difference.

2. Continue to have marked differences between candidates but alter the formal procedure so that it would force selection of the nonobvious man.

If differences were found in selections when informal and formal procedures were used, then weight would be lent to the arguments that it might be advantageous to formalize the procedure or that there are useful and interesting lessons to be learned by experimenting with procedures.

However, the most fruitful and rewarding continuation of this research would be to construct experiments to see what would happen to project success if new and different procedures from those outlined herein were used for project manager selection. The problems of control and measurement of results in such experiments would be very difficult. However, the main problem probably would be to try and persuade a decision maker to follow different procedures--for a revised procedure could select an unsuccessful project manager. But, it should be noted that the present process does not always produce success.

It is probable that no one will follow this suggestion, at least in a major way, in the forseeable future. However, a decision maker could take a modest step in this direction by selecting a man for project manager who does not quite fit the decision maker's "image" of what is required in a successful manager, perhaps merely by taking the man who was second or third choice. It is possible that the results might be surprising--in a happy direction. Since we know so little about what is truly the best process for picking managers, experiments of this nature could not help but increase our knowledge in this field. If it was found that alternate procedures did produce a higher percentage of failures, then we could conclude that our present procedures were "good". We might find that alternate procedures were equally effective and efficient and then we could conclude that perhaps there is no single "best" approach to some types of decisions. But I am confident that we would find that the process could be improved and that we are really rather inept and inefficient in our decision processes. What is now being done in making decisions may contain the essence of a "best" procedure, but it probably contains many irrational and extraneous details that becloud the issue.

Concluding Remarks

The purpose of this study was to try and see if the process of project manager selection would be found to be a process that was sufficiently understandable and describable that a pattern could be found among several decisions by several decision makers. I believe that my study has shown that the process is describable and that the main outlines of this pattern are as I have described them herein. Also, I

believe I have met one of my broader goals which was to try and find a means of improving that process. For, if the idea that the process does follow a pattern, or the idea that the process could be programmed, is accepted, then a certain amount of formality and routinization is bound to occur which will result in the decision maker using his judgment to better purpose in considering the remaining intangibles.

I also believe that I have attained another of my broad goals in that a degree of insight has been provided into the problem of human decision making in general. I feel that I have provided additional impetus to the idea that decisions which appear to be prima facie examples of situations that are too unstructured to allow for effective study can be studied by considering them as problems in programming. This bold statement is made with full realization that this study is but a modest additional step in application of this theory; perhaps one of its main values could be that others will be encouraged to use this method in studies of other decision processes. Management decisions have frequently been regarded as deep dark unknowables, but it seems that this is true only to the extent that we do not allow ourselves to know how to understand them. The theoretical approach on which the study of this thesis is based suggests that we can understand such decision processes and that there are means for testing our understanding. A vast, largely untapped, reservoir seems to be open for research and investigation using this approach.

Lest I be accused by the reader of starting with a pre-conceived idea and "proving" it to be true, it should be noted that when I started this research my hypothesis was: the process of selecting project

managers is inherently a process that cannot be described in any systematic way, since "people" are being selected and not "things". During the course of this interesting and personally rewarding study I have become a convert.

BIBLIOGRAPHY

Clarkson, Geoffrey P. E. Portfolio Selection: A Simulation of Trust Investment. New Jersey: Prentice Hall, Inc., 1962.

Clarkson, Geoffrey P. E. and Pounds, William F. "Theory and Method in the Exploration of Human Decision Behavior," Industrial Management Review, Fall, 1963.

Costello, Timothy W. and Zalkind, Sheldon S. Psychology in Administration: A Research Orientation. New Jersey: Prentice Hall, Inc., 1963, esp. Part Six.

Gaddis, Paul O. "The Project Manager," Harvard Business Review, May/June, 1959.

Katz, Robert L. "Skills of an Effective Administrator," Harvard Business Review, January/February, 1955.

Newell, Allen, Shaw, J. C., and Simon, Herbert A. "Elements of a Theory of Human Problem Solving," Psychological Review, May, 1958.

_____. "A General Problem-Solving Program for a Computer," Computers and Automation, VIII (July 1959), pp. 10-17.

Newell, Allen and Simon, Herbert A. "The Simulation of Human Thought," Current Trends in Psychological Theory, ed. Wayne Dennis, Univ. of Pittsburg Press, 1961.

Simon, Herbert A. The New Science of Management Decision, New York: Harper Row, 1960.